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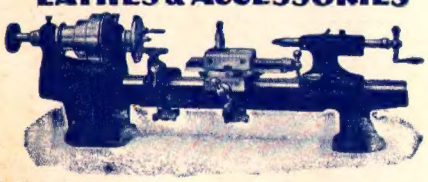

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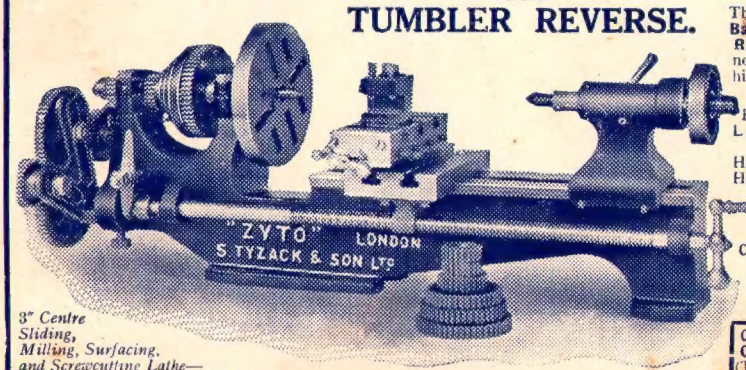

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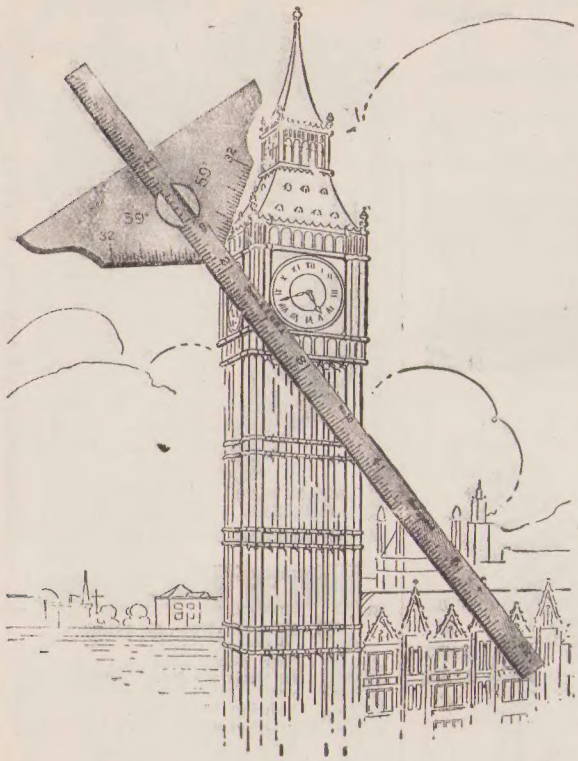

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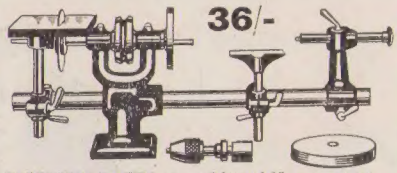

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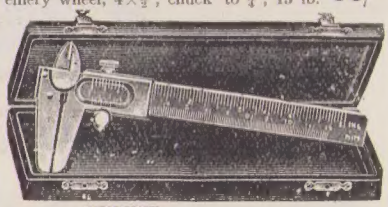

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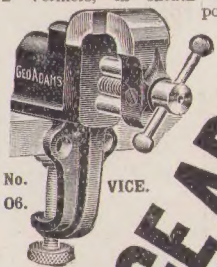

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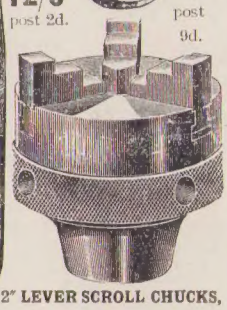

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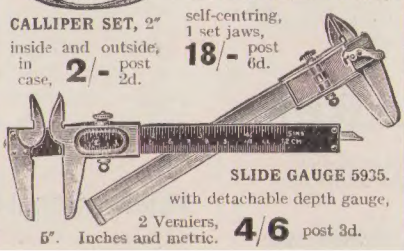

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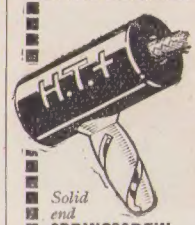

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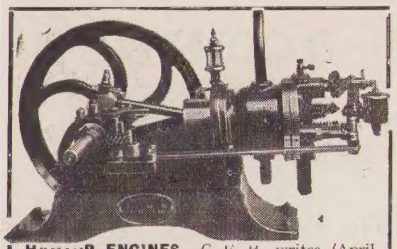

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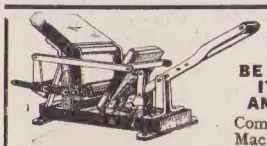

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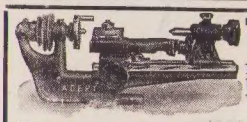

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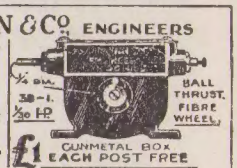

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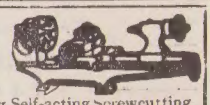

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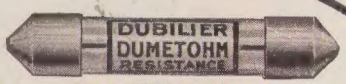

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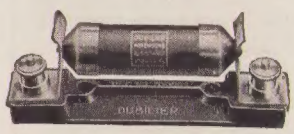

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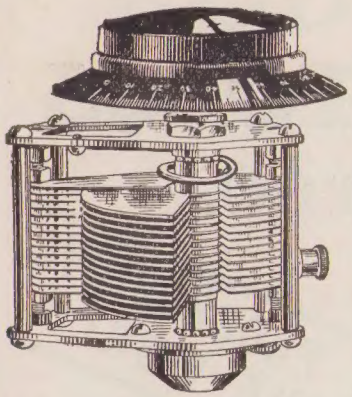

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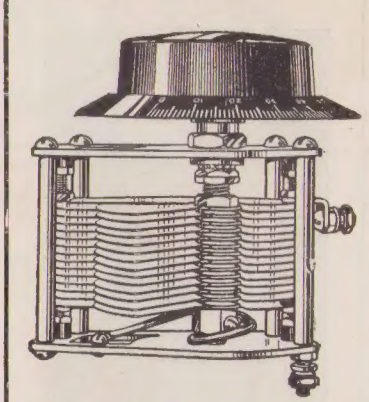

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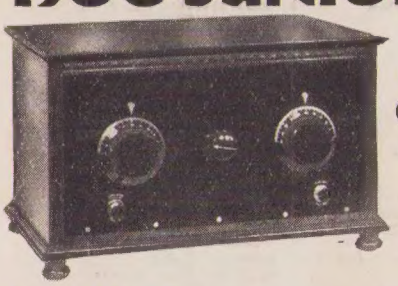

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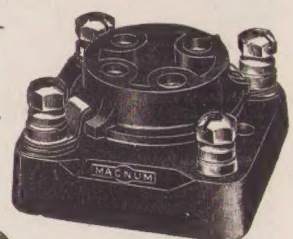

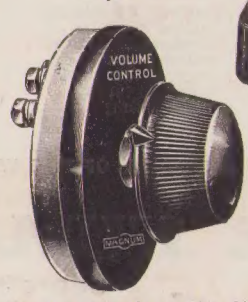

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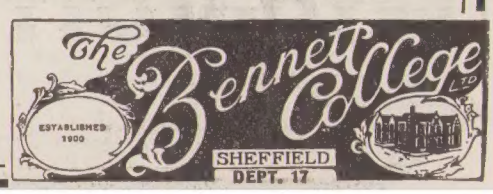

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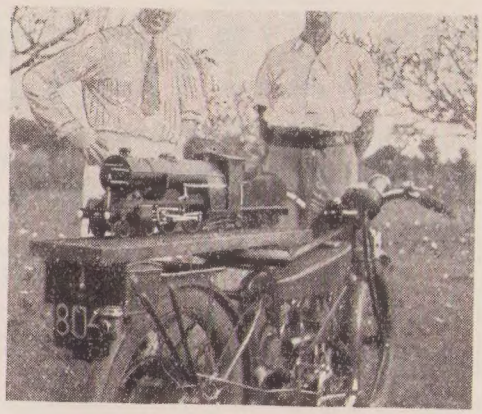
SMOKE RINGS

THOSE members of the Society of Model and Experimental Engineers who journeyed to Pritchards' Restaurant on Saturday, April 5, for their Annual Dinner, were not disappointed in their expectation of a thoroughly enjoyable evening. I think the attendance broke record; at any rate, the room was filled, and, thanks to the good organisation by the executive and the popular Secretary, Mr. R. W. Wright, everything went like clockwork. The President, Mr. L. M. G. Ferreira, M.Inst.C.E., occupied the chair in his usual genial and efficient manner, and opened the proceedings by expressing a very cordial welcome to the members and guests. The speeches during the evening were commendably brief and to the point. Mr. H. G. M. Conybeare, whom everybody was pleased to see looking very well, proposed the toast of "The Ladies and Visitors," and this was suitably acknowledged by Mr. Shepherd. "Uncle Jim" Crebbin gave "The Society," and very briefly traced the progress the organisation had made since its foundation in 1898. He emphasised the great advance which had been made in the quality of craftsmanship amongst the members, and said the Society was now producing work which would bear comparison with any professional model-maker's productions. Mr. J. N. Maskelyne, who responded, also touched on this subject, and contended that the existence of the Society was more than justified by its influence in keeping handicraft skill alive. He expressed pleasure at seeing a number of members present who had come a long way to attend the dinner, and in particular welcomed Dr. and Mrs. R. L. Robinson, who had travelled all the way from Somerset. The concluding toast of "The Chairman" was happily proposed by Mr. G. W. Vickerage, who, in referring to Mr. Ferreira's distinction in the engineering profession, said that the Society owed a great deal to their professional members, who were so willing to give encouragement and helpful advice to those who were less advanced in their engineering knowledge. The toast was enthusiastically received, and in his response Mr. Ferreira said that while he was very happy in occupying the chair on that occasion, he really felt more at home in addressing them on technical rather than on social subjects. As they all knew, he was a "stickler" for good work, and he would like to confirm what had been said that evening about the great improvement in the members' work over that he used to see twenty years ago. That had come about through the exchange of knowledge and experience, and through the opportunities of seeing good work at their meetings, and he felt quite sure the Society would continue to make good progress in this respect. The musical programme was one of the best the Society has yet had on these occasions. Mr. G. W. Randell was the mainspring on the platform, and was ably supported by Mr. Ivor Richards, at the piano, and Miss Bertha Sparks, Mr. C. S. Akers, Mr. H. R. Fripp, and Mr. Billy West. Mr. Randell opened the concert with two very appropriate items, "The Driver of the 8.15," and a model engineering song full of amusing references to the home workshop, and to certain members of the Society. The "living marionette" show was as popular as ever, and two very much appreciated items were a song written and composed by Mr. Ivor Richards, and one entitled "April," written and composed by Mr. J. N. Maskelyne, who thus gave another proof that the model engineer is frequently a real artist in other directions. Everybody voted the evening a great success, an opinion in which I heartily concurred.

MR. GEORGE E. SMITH sends me the accompanying snapshot from Nigeria, where he is astonishing the natives with the wonderful performance of the fine little locomotive seen in the picture. The engine is coal-fired and will pull a load of 24 stone. A total weight of 67 lbs., a boiler pressure of 80 lbs., a superheater with proper spearhead elements, and Walschaerts valve gear cutting off at 75 per cent. are other points of interest, and Mr. Smith adds that he has now put a pukka lubricator in the cab after the style of a Wakefield sight-feed. He says that he has been a reader of THE MODEL ENGINEER since serving his apprenticeship, and now out in Nigeria the paper "holds second place to my wife's letters from home." What higher compliment than this could there be?



Warm Work in Nigeria.

* * *

FOLLOWING my recent reference to the possibility of British model-making firms being represented at the Buenos Aires Exhibition early in 1931, I have received an interesting letter from the Federation of British Industries in which a scheme for a composite exhibit is outlined. This scheme is being specially arranged for firms who cannot see their way to taking a complete stand of their own, and includes the provision of a number of suitable showcases which can be hired at an inclusive fee covering attendance, illumination, cleaning and other incidental expenses during the six weeks' period of the show. This seems to present an excellent opportunity for firms desiring to make a modest but effective exhibit in a prosperous market, and I hope some of the model engineering firms of this country will take advantage of the facilities offered by the Federation. Enquiries should be addressed to the Assistant Secretary, Exhibition Section, Federation of British Industries, 39, St. James's Street, London, S.W.1.

Percival Marshall

Machine Telegraphy in the Future.

TO some of our readers Mr. H. H. Harrison, M.I.E.E., is known through his book "Model Steam Turbines," but it does not reveal that he has a special knowledge of the art and practice of telegraphy. In the year 1916 he compiled a remarkable paper on "The Principles of Modern Printing Telegraphy," read before the Institution of Electrical Engineers. We published an abstract in our volumes 34 and 35. Recently, March 27, he presented to the same Institution another paper entitled "Developments in Machine Telegraph Systems and Methods of Operation." This paper, of extraordinarily comprehensive nature, consists of nearly 85 pages and includes 139 illustrations.

A Special Advantage of Telegraphy.

It may appear that with the great development of telephony, diminishing use of telegraphy will occur. Mr. Harrison's paper and the discussion which followed it forecast, however, a wide extension of use for telegraphy. The peculiar advantage of printed instead of spoken messages is with telegraphy. In the future, by the forecast we mention, business firms will be inter-connected through telegraphy, and by use of machine telegraphs and also having their own lines, telegraphy will enable direct printed messages, without necessity of retransmission, to be used in substitute for telephone messages. This will greatly facilitate important communications and conduct of business.

Conducing to this development is the instrument known in telegraphy as the regenerative repeater, and to quote from the paper, "the telephone pair with its series loading and its repeater stations en route to be used for either the transmission of telegraph signals or speech, or both, simultaneously and independently. Wherever the telephone network extends, the telegraph network is ready to hand."

The Last Phase of Machine Telegraphy.

"The last phase of machine telegraphy will certainly be that in which inter-communication between centres will be automatically effected and intermediate manual transmission avoided." The paper, dealing with limitations in long-distance telephony, states, "It is possible to telephone westwards (assuming normal business hours) only between 2 and 5 p.m. Talking eastwards must proceed in the morning, and commencing at 9 o'clock a.m. cannot be carried out further east than China. These differences of time constitute the only factor operating against worldwide telephony. Their sole effect on telegraphy is to cause a change in the direction of traffic which flows eastward and westward alternately except for short periods when the working day overlaps."

"The problem to be solved is the abolition of retransmission. There is only one way—it may be called the last phase of machine telegraphy—in which this can be accomplished, and that is the adoption of machine switching."

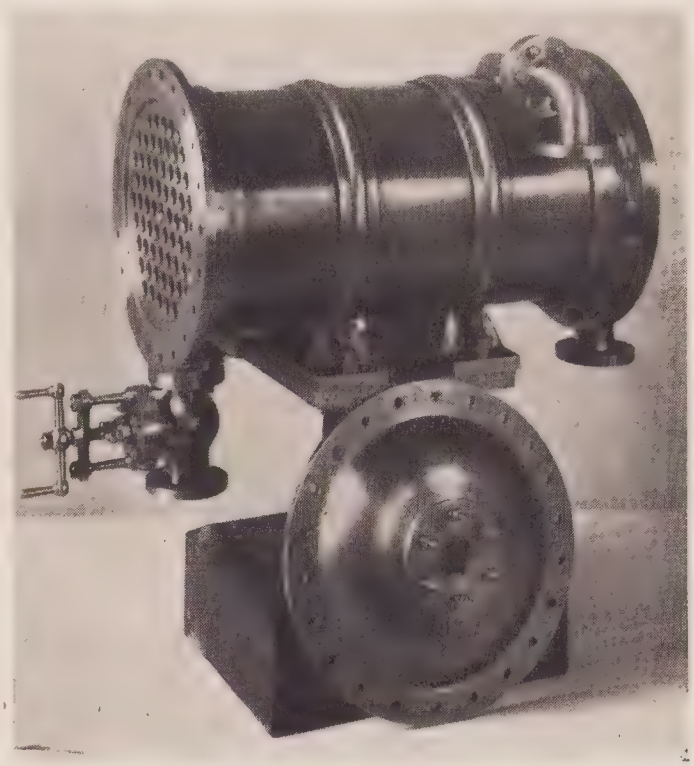
Making a Condenser for Steam Engine

with Cylinders $1\frac{3}{8}$-in. by 2-in. by $2\frac{1}{4}$-in. Stroke.

By H. Booth.

WISHING to fit up a condenser with air and circulating pumps to a tandem compound horizontal engine that I recently built, I first got out a set of drawings (rough, no doubt, but I could understand them), then set about and made the patterns. Next I got the castings made from the latter by a firm of MODEL ENGINEER advertisers, and they were quite good, too. The result is a most effective and good-looking job.

First I procured a piece of 3-in. outside diameter drawn brass tube, 7 ins. long, and of good quality. This was faced up square at both ends and a piece of medium-grade emery-cloth run over both inside and outside—a simple operation which saves quite a lot of trouble when the soldering and sweating process comes along. Next the two castings which form both the strengthening rings around body and the holding-down brackets as well were filed up and made to take paint nicely, and trued up on bottom face. In my case these were milled, being bolted to lathe top-slide and fed up to a 1-in. diameter end-mill held in self-centring chuck, care being taken not to distort the casting by bolting down too tight. Light cuts were taken. Afterwards these were marked out and drilled. All this work I preferred to do before boring out a nice push-on fit on outside of tube as by so doing the risk of distorting by holding in vice, etc., after boring was obviated. These two castings are somewhat light for two-thirds their diameter.



A View of the Condenser with Cover Removed.

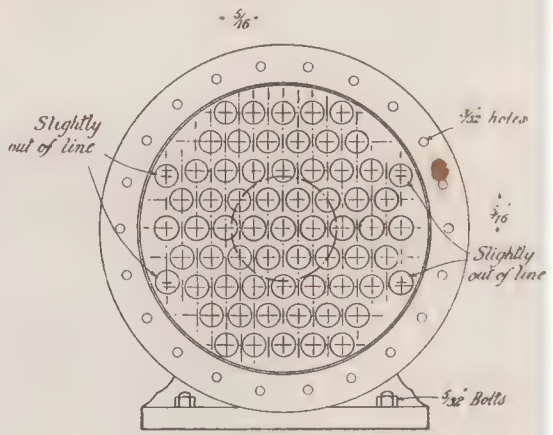
The boring was a straightforward job, holding them in s.c. chuck lightly, and testing for square off front of chuck to bolting-down face. This is important and must be observed if the job is to come out square when fixed in place on body of condenser. These were now marked out for five 3/32nd-in. holes on either side of casting. The holes were not drilled opposite each other but were "staggered." The castings were now pushed on tube and correct position arrived at by testing on lathe bed. After making sure the feet were flat and true with each other, I drilled right through 3/32nd in., the holes being slightly countersunk on outside. They were then riveted in with 3/32nd-in. by $\frac{1}{4}$-in. snap-head copper rivets and filed flush on outside. If these castings are a real good fit on body, it will only be found necessary to sweat round the rivet heads inside the tube, but if they are not the whole will have to be nicely sweated on before riveting up finally. The two end angle rings were now chucked and bored out a good fit for each end of tube, they being in turn held lightly by "outside" jaws and at the same time faced on bolting-up side so as to be true with bore.

The "inside" jaws were next brought into use and the rings gripped on inside, being sure the face is held hard up against the chuck jaws, turned to desired dimensions, taken out and pressed on ends of tube, marked out for twelve 3/32nd-in. holes and drilled right through, countersunk on outside and riveted in position. In all cases, care must be taken to file off any "burrs" or "flash" on inside of tube before rivets are put in.

The next job is to turn up two seatings for circulating water pipes. These are 1 in. diameter and 3/16th in. thick, filed to suit the $1\frac{1}{2}$-in. radius of tube on one side with 5/16th-in. hole in centre. These are drilled for four 3/32nd-in. rivets, countersunk on flat face, sweated and riveted in position on body, which had previously been marked out for correct

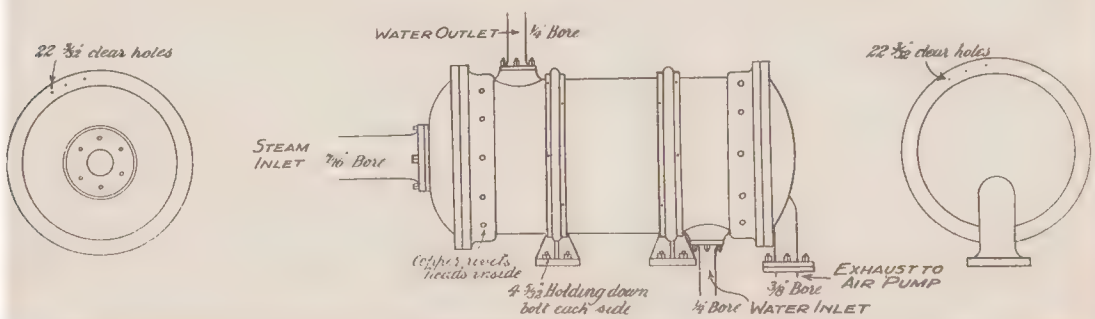
position. When these are fixed, put 5/16th-in. drill right through; you then get a true hole and the fixed seating acts as a jig and prevents 5/16th-in. drill from "running." These seatings are afterwards drilled to take four 3/32nd-in. studs or screws as desired. Care must be taken when drilling not to go right through or sweating will have to be resorted to on inside before steam tubes are fixed. At this point it would be as well to sweat round *all* the rivet heads on the inside. If the end angle-rings were a good fit, it will be only necessary to sweat round the end of tube and ring face at the same time as the tube plates are fixed, but if they were at all slack they must be sweated previous to riveting. The two tube plates were now chucked and turned up all over, leaving them a nice fit in tube and about $\frac{1}{8}$ in. thick. When both are turned up, sweat them together, taking care to get them true round the outside edge. It would be a good wheeze to slightly chamfer the outside edge of these tube plates while in the chuck so that the solder, when sweating in, will run into the groove and make a real sound joint. Where the plates are sweated up and cooled off, mark out for sixty-five $\frac{1}{4}$-in. diameter holes. These holes were drilled 6 mm. and reamed out $\frac{1}{4}$ in. while still stuck together, the reamer being held in the chuck of hand brace. Care must be taken over this job to keep square. If one has a drill-press this is an easy operation. The holes were then all slightly countersunk on outside to form fillet for solder when sweating in tubes. Unsweat the plates and press one into position, making sure it rests on the rivet heads that bind the end angle tubes; this ensures a definite location. Now pass several lengths of $\frac{1}{4}$-in. rod through holes into the corresponding holes in other plate, and then press No. 2 plate home. The holes will then be in perfect alignment with each other. Just a tip here: when pressing in first plate, see that all the tubes will miss the projecting rivet heads on inside.

Next cut off the $\frac{1}{4}$-in. tubes, sixty-five in number; sixty-four to be 1/16th in. longer than the distance between the outside of tube plates, and the other one, which is the centre one, is to be $\frac{3}{8}$ in. longer to accommodate a deflector. A most effective way of cutting these tubes to length is as follows: Using s.c. chuck to hold tube in, the ordinary way, put into the back poppet a piece of stock or anything with a flat face, put a very narrow parting tool in tool-post and let tool come as near as possible to chuck jaws. Carefully mark off the length of one tube, placing mark on the side of tool next to poppet, bring back poppet with stock in position and lock permanently, cut off tube, release chuck, and bring up stock tube again to the definite stop; cut off again, and so on. Do not move slide rest or poppet, but use cross-slide only. This, of course, only applies to lathes that have a hollow mandrel. While the cutting off is being done, hold a piece of emery-cloth on the ends to clear away any flash and also clean ends to take the solder easily. This is one of the little "big" items but saves quite a lot of trouble. Now cut off one tube $\frac{3}{8}$ in. longer than the rest for the centre, split down, and turn the ends over about 3/16th in. or $\frac{1}{4}$ in., and solder on a disc of thin brass about 1 in. diameter that has been beaten concave with the ball-pane of hammer on a piece of sheet lead. This is to prevent the steam from rushing in force down the few central tubes. Now insert all the tubes in tube plates, leaving ends protruding 1/32nd in. each end of plates. The centre one, of course, will stick out much more at the front end. Care must be taken not to block up the tubes immediately at back of deflector.

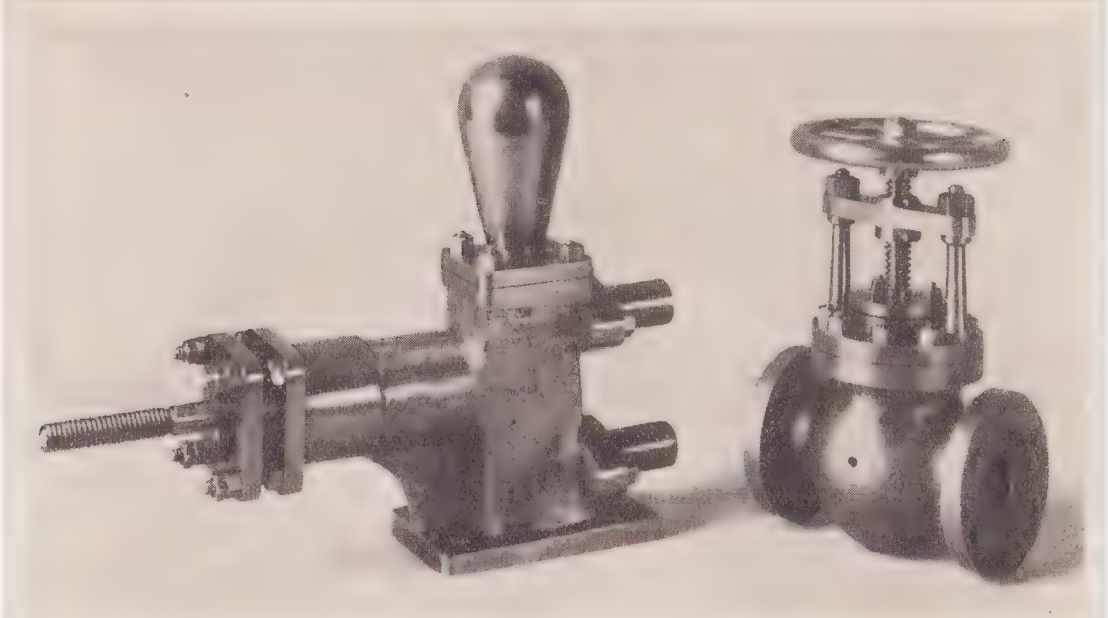


End View showing Tubes.

Next take a piece of 5/16th-in. diameter silver steel, turn a suitable taper (not too steep), leaving a good surface, then file three flats on it, these flats to be parallel with the taper; harden and temper and then hone off the edges of the radius left at three points, and you will have quite a good tube expander. About three or four turns with slight pressure will suffice to make a good job. The best way is to hold expander in small drill brace. The expander must have a perfectly smooth surface on all three working edges or it will scour the tube ends and wreck the job even if a lubricant is used. Next sweat the whole lot up together, care being taken not to let solder block up any of the tubes. This can best be done with a small blowlamp or gas blowpipe. In my case, I used the ordinary



Elevations of Condenser.



View of Pump and Stop Valve.

domestic gas-ring with a piece of brass tube bent at one end and tinned at the other for a mouth-piece. Localise the heat as much as possible so as not to set any of the other sweated parts running. It's easy enough to manage. This operation being satisfactory, grip in lathe chuck, and very carefully, with light cuts, skim up all tube ends and also take off any spare solder.

The end covers were now proceeded with, the front one was turned up all over and is a simple job. The steam inlet pipe flange seat was left $1\frac{1}{8}$ ins. diameter with 7/16th-in. hole in centre, marked off and drilled for six 3/32nd-in. tapped holes for studs or screws. The rear cover has the part exhaust pipe to air pump cast integral and so is a bit more awkward. First drill out the bore $\frac{3}{8}$ in., press on to a piece of $\frac{3}{8}$-in. stock put in s.c. chuck, and turn up flange all over; this latter to be 1 1/16th ins. diameter and $\frac{1}{8}$ in. thick. When this is done, chuck and turn up the bolting-up face and turn over the top as far as the pipe will allow; the remainder will have to be filed off carefully. Next mark off one cover (the front) for 22 equidistant 3/32nd-in. holes and use this for a jig for the other cover and also both ends of condenser. The only thing to watch is that the back cover is perfectly upright on pipe, otherwise this will be unpleasant to the eye. The two holes at back of pipe must be tapped to take studs or screws, and must not be drilled through. The whole was next bolted together using oiled paper to make joints, and tested both for inside tubes and water space. There was not a leak anywhere. Rubbed all over with smooth emery-cloth and any marks carefully filed out, given a coat of "Robbialac," which, when dried off well, was rubbed down and then given one more coat, and a very nice job it looked. Although this condenser was designed for a horizontal engine, with but very little alteration it would be suitable for almost any type of engine. I will add, in conclusion, that the thinner the steam tubes are the more effective the condenser will be.

Should any reader decide to build one, castings are available in gunmetal or brass.

With the editor's permission I intend at a future date to describe the water pump and also the air pump made to work in conjunction with this condenser.

Working Model 00-Gauge Steam Loco.

By Eric H. P. Liddell.

THE following is a brief account of a model steam loco to approximately scale proportions and general appearance of the real thing, and which is a practical working steam model at the same time. So far as I know this has not been accomplished before; if it has, however, it would interest me and probably others to hear about any other genuine working steam loco built for this gauge.

I'll admit to commence with that I was rather lazy in my anxiety to design a practical working model with the least possible amount of working parts, but, like most lazy people, I probably had to do more work in making the tiny double-action oscillating engine (which is the real motive-power of the loco), together with its gearing to the driving wheels, and suitably camouflaging the same, than if I had, in the first place, designed and made a pair of "pukka" cylinders—which I am now endeavouring to do.

However, having decided that a double-action oscillator would be interesting, and save a good deal of time, I was led to choose a tank loco, whose enclosed cab would provide a suitable

hiding place for the little engine. In the actual model shown in the accompanying photo, not only the engine but also the displacement lubricator and reversing gear are housed inside the cab, the regulator (and reversing gear lever, which are one) projects through the back of cab, over the coal bunker

The prototype from which the model is taken is one of the latest type of L.M.S. shunting locos of the outside cylinder, six-coupled type (o—6—o), one of which is numbered as the model, *i.e.*, 11277.

Before leaving the cylinder part, it may be of interest to note that one disadvantage of adopting the single engine is that when steam is turned on it will not always start right away, as there are necessarily two dead centres, very often it will start, of course, but one cannot rely on it getting away like a two-cylinder loco would do.

The boiler is made from light gauge brass tube, ends turned from rod, the front end has smoke-box door, etc., turned on, hinges and fastening handles, rail, etc., being fitted after.

piston-rods, connecting-rods, and ("delightfully simple") valve gear all work, and look quite realistic when the loco is travelling.

Steam is taken from top of dome, led through flame (a spirit lamp) to engine. Exhaust steam is led up the funnel.

To forestall possible queries, I may say that the loco is not fitted with a chime whistle, also real sanding gear and working brakes have not yet been attempted; however, even a real coal-burning loco in this size will possibly be built one day. After all, this is hardly more improbable now than was the advent of the o-gauge coal-burning loco some few years back.

It may interest readers to know that it took about three months of spare time work, which was sandwiched in between the—comparatively, at any rate—humdrum mechanical and electrical work comprising the writer's ordinary daily routine, to design and make this model loco, and also that all the turning, and most of the drilling for it, was done on a 1913 pattern Drummond 3½-in. lathe, which is an excellent

Working Model 00 Gauge Locomotive.

Both the funnel and dome and also the wheels are turned from rod, no castings or parts being available for this size loco.

The size boiler fitted steams the loco from twelve to fifteen minutes; the next model I make, which is to have two working cylinders in their correct position, will allow of the boiler barrel being extended into cab, where, in the present case, the engine occupies this room, which should result in a considerably longer run. The time mentioned is with the loco "all out" all the time.

It has pulled from a standstill, under its own steam, a o-gauge tinplate wagon, loaded with lead, and the total made up to 2 lbs. 10 ozs.; a small amount of this weight had to be slung over the loco itself, however, to prevent the wheels skidding round on the smooth linoleum floor on which the test was made—no rails were available at the time, probably slipping would be much less noticeable on rails, as the flanges of these little wheels are almost a blunt knife edge. The loco weighs 8 ozs.

The outside cylinders are "dummy," but the tool, but a little on the heavy side for such small work.

The numerous fine measurements required were mostly made by a Columbus sliding gauge given me by the Editor about the year 1903 for a description of one of my early efforts at model boiler making.

Should any manufacturing firm thinking of producing a steam loco in oo-gauge be interested in this design, the writer would be very pleased to hear from them.

The lettering on the tanks, "L.M.S.," which should appear very boldly, hardly shows up at all in the photo.

Since photo was taken spokes have been painted on the wheels, also balance-weights.

The loco is supported on a match-box, which will give some idea of its general proportions.

A Canadian Road Suspension Bridge.

The largest rope-strand suspension bridge in the world is that over the St. Maurice River at Grand Mère, P.Q., Canada, a road bridge, the main span of which is 049 ft.

The Trials of a Clockmaker.

By John Ross.

MY troubles were all caused by the remark of a customer and Mr. Gentry.

I am a country watchmaker and never made a model in my life, and as model-makers seem to be a select family, they may think I have no right to be butting in on their business, but, as Mr. Gentry started butting in on mine, I will retaliate, if the Editor permits.

I have been a reader of THE MODEL ENGINEER for many years (as every good watchmaker should be), and I have picked up innumerable tips and ways of doing things, which I have applied to my own business. Some of its writers are like old friends to me.

* * *

I have a customer, who is a collector of antiques—principally old clocks and watches. He often grumbled to me that he could not get anyone to repair these old things for him properly. In a weak moment I consented to do a few, and ever afterwards he stuck to me like a leech, until now it was easier to do them than refuse.

Now a verge watch (they are generally from a hundred to two hundred years old), simple in theory, big and rough as its looks, is anything but a simple watch to make keep correct time. And to their age—the work of the men who have been on the job before you, with file, hammer and soft solder, and "L.B.S.C." repairing his dud engines is not a patch on it.

Some time ago this customer tumbled in with a particularly wicked specimen, requiring, among a host of other things, an engraved and sawpierced bar. As I can do engraving I could do the bar all right, but fine sawpiercing is very tricky work unless you have plenty of time and practice. But all these old watches were beautifully ornamented in this way.

* * *

By the way, why do model-makers all leave their work so plain? Why not infuse a little artistic taste into it? All model engines look alike, an exact copy of the real thing. I have even seen someone criticising the shape of the bolt heads because they were not the same as the original.

If these models were made as a standard to copy the big ones from I could understand it, but most of them are made for the love of making them, to stand in glass cases, as an ornament. So why not make them ornamental? By ornamenting, I do not mean painting and gold lining. Take a connecting-rod, just a plain piece of steel, and that's all there is to it. Why not make it with ornamental curves, and fret out the centre to an open design? Done properly, it can make you take notice. I would carry this idea right all through. It would at least take the mass-production look out of it.

There is another thing, while I am at it. I have seen you sneer at "mere polish." Don't! You are giving yourselves away, because the man who can polish properly is certainly no slough. To get a good deep polish on a piece of steel of any size is about as temper-trying a job as you ever tackled. A model engine, or any model, should certainly be polished, it brings out the beauty of the work. A railway engine is for utility—a model is made to be handled and admired. That's an outsider's idea of it anyhow.

When my customer and I had agreed about the difficulties in renewing this watch, he leaned over the counter and said: "But after all you fellows are only cobblers, you have 'watch and clockmakers' on your signs, but you never made a clock, and you could not."

Now this was about the limit. I was doing work for him that any of my workmen could not do; and probably not three men in the British Isles could do it for him, and he was calling me a cobbler! And the worst of it was that it was partly true. I had never actually made a clock, but had made most of the different parts in the course of repairing so I knew all about it. And Mr. Gentry's articles put the idea into my head to do it. I sent off for the makings of an English dial clock, all in the rough, but with the wheel teeth cut. That is a clock about 10 ins. high, with a chain and fusee and driven with a mainspring—not weights as in Mr. Gentry's. I chose this style of clock so that I could put it in a glass case and stand it on the counter for my antique friend to see.

There was nothing particular in the making of it; all straightforward work. But there is one thing I think Mr. Gentry did not elaborate enough, that is the care needed in pitching the wheels. I did it with a compass and a piece of zinc, bored the holes in the zinc and tried the wheels in, noted where I was deep or shallow, and then used the zinc plate as a template and bored both clock plates together. It is safer to be deep than shallow, as a deep wheel can be topped, but a shallow depth upsets the whole clock.

Mr. Gentry's instructions and drawings are so clear that anyone could make a clock from them. In the old days the rack teeth were cut by hand, and are not even spaced, as Mr. Gentry noted. As some of the makers following his instructions will have to cut them the same way, it is necessary to tell them how this was got over, or their snails will get out of step with the rack unless they are very careful in copying his measurements.

The striking work is all finished, except the snail, and the clock put together, with the snail blank screwed on to the hour wheel. A sharp steel point is driven into the rack tail, place the rack hook in the first tooth of the rack, and press the steel point in the rack tail on to the snail blank and mark it, by turning the blank slightly. That's one o'clock, then two, and mark, and so on. The radial lines are marked by turning the minute wheel once round and mark for each line; cut your snail to these marks.

One other item, Mr. Gentry, and that is the method you give for truing the wheels if the teeth cutters send them with the centre out of truth. I would not like to press the teeth of a scape wheel into a piece of hard wood, and

maybe a dig-in or two, and chance bringing it out again with the teeth as they should be. You are holding the wheel at its most delicate point. I have seen a lead block used that way, but this is a better plan: Get a brass or a steel rod and turn it dead true, to fit the hole in the lathe mandrel, let the end project about 3 ins. Take a brass plate 3 or 4 ins. in diameter, not less than $\frac{1}{8}$ in. thick, bore a hole in the centre, and fit carefully to the rod (very little riveting will do), true all up, and turn a few concentric rings on the face of the plate, then bore a hole through the rod about an inch from the brass plate. This hole is to prevent the heat escaping to the lathe head, so make it fairly large; heat up the plate with your lamp and put a few bits of shellac or wax on it. Do not heat beyond melting the shellac, warm the wheel and put it on to the plate, run the lathe slow, and, with a match or something light resting on the hand-rest, tip the points of the teeth until the wheel runs true.

If you had a job where the centre was true, but the rim out, such as a wheel blank, bring up the back stock with a male centre in, and when the plate is hot, simply screw the male centre into the hole in the blank and the thing is dead true at once.

These plates are much superior to chucks, or anything else where true turning is of importance, and are splendid for delicate work.

I made my clock in about a month of odds and ends of spare time, polished it nicely and put it into an empty fountain-pen case which just fitted it, and set it going on the counter, without a dial. I was certainly astonished at the interest my customers took in it.

"It was beautiful," etc., etc. (that was polish and finish, model-makers), and who does not feel gratified when their work is admired? I could have sold it many times at a good price.

Now here my troubles began. These cute ones who are always nosing around stirring up trouble for somebody commenced asking questions, such as:—

"Did you make all the teeth on these wheels?"

"No."

"Or cut the pinions?"

"No."

"Oh! I see; just bought the pieces and screwed them together, like a wireless set."

After digesting a few samples of that kind of thing, I resolved that it should not occur in my next clock. I had discovered by this time that many people are willing to pay a good price for a piece of decent hand work, as it is becoming so rare in clocks, since that abomination of mass production has made men slaves to machines.

That reminds me of old Mr. Williams who comes to see me occasionally on business. He made grandfather clocks about fifty years ago in Birmingham. He tells me that they started work at six o'clock in the morning and worked until six at night, and ten on Saturdays. He made roughly three clocks in a fortnight, and the price they got for them in Birmingham was 27s. 6d. with blued pinions, and 25s. left bright. A hand-made grandfather clock for 25s., half the price of the raw material to-day!

I set about getting a wheel-cutting machine, and just at this time an old pirate in L—— was advertising one (not in The Model Engineer), so I bought it without seeing it, and got it, over half a ton of it, and about a hundred years of age, thrown in free. I very soon discovered that cutting wheels does not come by instinct, particularly when the cutter arbor is too short to get the cutter in centre, the arbor screws out of truth, and the cutter slide working in jerks.

The man whom I bought that machine from must have used it for making corkscrews, for the first few teeth were like that. Finally, after a "sair fecht" with that machine, I was able to cut fairly decent teeth. I had a collection of pinions, wheel blanks, etc., drew out my clock, and came my next cropper.

In my ignorance I imagined that if I made a fly cutter to fit between the leaves of a pinion, and put the blank wheel in the machine, and cutting the number of teeth in the blank that I wanted, that pinion and wheel would gear. But it was no go. I tried several cutters of different sizes, but none of the results was just right. By taking an ordinary clock I saw from the cut of the wheel teeth what sized cutter had been used to suit that particular pinion; but that did not help much. It would be easy to cut the teeth 44 pitch or whatever I choose, and fit pinions to that, but then I am not making clocks with ordinary trains. I wrote the firm who cut the teeth of my first clock and they replied. They did not know how I could sector pinions from uncut wheels. No help there! Can Mr. Gentry or someone tell me a practical way to measure a pinion, so that I can make a cutter from the measurement that will cut the teeth of the wheel to pitch with it accurately?

Watchmakers' books are woefully destitute of any information regarding wheel and pinion making. The theory of gearing is there all right, but nothing practical, or, at least, nothing that fits my case. And, as "L.B.S.C." very truthfully remarks, practice is a queer kite, for you cannot make a clock or watch theoretically correct, for the simple reason that a pinion cannot be made to the exact mathematical proportion because of the processes that have to be adopted for cutting, centring, polishing. The same applies in a certain degree to the wheel teeth. Funny, is it not? We must learn a theory which in practice is impossible.

It is said that the German professors used to make the facts to fit their theories; surely ours could make a theory to fit the clocks.

I have just seen Captain Somerville's remarks about the hammer tail not being in the right place. Old clock-makers paid very little heed to things like that, but they were particular that the clock should have run before engaging the hammer tail. Anyhow, when the owner found his clock getting lazy in the striking, he lugged out a piece of old iron or something and hung it on to the sixteen-pound weight, and that made the most refractory clock buck up. I have seen two flat-irons hanging on to the going side weight.

Transport Costs.

In an address to the Association of Mining Electrical Engineers, Capt. S. Walton Brown pointed out that to send an average ton of coal by rail 100 miles costs more than the value of the coal itself. Where?

The PRACTICAL ELECTRICIAN
LIGHTING·POWER·MAINTENANCE·REPAIRS

Modern Electrical Installation Work.

By Frederic H. Taylor,
A.M.Inst.E.E., A.M.Inst.M.E.

(*Continued from page* 346.)

"Whole or Part" and "Series-parallel" Switches.

These two types of multiple-way switches are worthy of a passing reference. The "whole-or-part" is made with an "off" position, thus providing in one switch, for all the lamps or circuit on, part on only, or all off.

The "series-parallel," as it names implies, enables one to control two circuits, or lamps, either in series or in parallel with each other. Obviously, therefore, it has many uses either for lighting or for small heating circuits. For lighting, the lamps would give their full light from the parallel position or would burn very dim in the series. Similarly, on a heating circuit the series position would give low heat and the parallel position, full heat. These switches are provided with an "off" position.

Restrictive Circuit Switching.

The diagram (Fig. 24) shows a method of restrictive switching introduced by Messrs. A. P. Lundberg & Sons. This is of great value where the lighting of a series of adjoining store-rooms or cellars, etc., requires to be controlled, and where one room or apartment only is used at a time. In the diagram (Fig. 24), it is assumed that there are six such rooms with one light in each. The example given in the diagram provides for the use of an ordinary single-way, single-pole switch at E, which is the only point of entry to, and exit from, the group of six rooms, each of which is provided with a lamp L. All the other switches are two-way switches which have had their brass links removed, thus providing four terminals in each one. When the switches are all turned on as shown by the full lines in the diagram, a person entering at E turns on the single-way switch. This causes L1 to light up. Walking to S1, he turns the switch on to the other contact, thus putting out L1 and turning on L2. Arriving at S2, the switch there is turned over, thus extinguishing L2 and lighting up L3, and so the process continues. On the return journey, the switches are one after the other put back to their first position, consequently putting out the lamps behind and lighting up those in front. On leaving, the single-way switch at E is put off and thus the last lamp is extinguished.

Position, Use, and Wiring-up of Lamp Switches.

Switches are generally placed *inside* the room whose lamps they are intended to control. Cases where switches should be placed *external* to the room include safes, strong-rooms, and certain factories where explosive or highly inflammable gases are present in the atmosphere and in appreciable quantities. With regard to this latter point, it is well to consult the Home Office Rules which govern the use of electricity in factories.

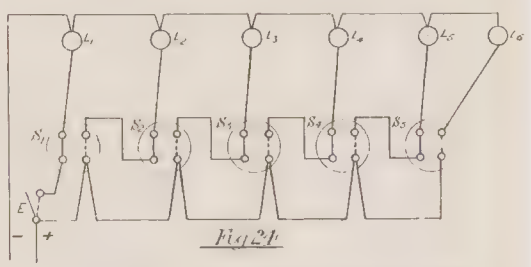


Fig 24.

An Example of Restrictive Circuit Switching.

Fixing Height for Switches.

There is no standard height for the fixing of switches in ordinary rooms or places, the height being chosen to suit one's convenience, but in garages where petrol-driven vehicles are stored or repaired any switch (or plug) must be fixed not less than six feet above the floor (I.E.E. Regulations 67J and 112H).

Ordinary tumbler (or turn type) switches should *not* be fitted in positions where moisture or even dampness prevails. Such positions as conservatories, winter gardens, palm courts, laundries, parts of breweries, etc., and sometimes cellars, should be fitted with iron-clad switches which are completely enclosed and rendered water-tight, and in any position which would ordinarily be considered dry care must be taken that dampness be kept away from switches as much as from other electrical apparatus.

In wiring up switches the installation man should see that the connection is properly made. The ends of the wires should not stick up out of the terminal. It is, however, best to let the wire project through and to bend it over close to the side of the terminal, then, should it be necessary to renew the switch later on there will be an end of sufficient length to get hold of. Also, it is well to leave a little "slack" behind the switch, which will likewise facilitate refixing when the time comes. Never cut off the wire flush with the terminal, and always see that you have a good firm connection such as will not easily get loose from the vibration of the surface on which it is fixed.

In trimming off the end of the wire care must be taken that neither tape nor braid is left in contact with the china and also that no naked (*i.e.*, uninsulated) wire is left so that it may touch the china, but that the V.I.R. insulation is taken right up to the brass of the terminal.

Rating of Switches.

The ordinary tumbler switch is usually rated as of 5 or 10-ampere size. A few manufacturers, however, make smaller sizes, such as 2 or 3 amperes, but the ordinary lamp switch is commonly described as a "5-ampere tumbler." This is an unfortunate practice, as in most cases they are ill suited to carry any such current, the reason being that although the actual area of the contact be, say 5/16th in. by ¼ in., usually only a small part of this is in actual contact, and in some cases only a mere point, and through this point all the current carried by the switch has to pass. If such a current is passed through such a switch, the result can only be excessive heating.

(*To be continued.*)

Electrical Questions and Answers.

41. Q.—If a break occurs on the neutral of a three-wire system, it is seen that the balance of the system is disurbed resulting, if the loads are unequal, in over-volting on the one side and under-volting on the other. What will be the result of a break on either outer?

A.—If one of the outers be broken, the supply to the faulty side will be cut off, and the neutral may be overloaded with current, but the voltage would not rise on the side which was in order for the reason that the generating plant is arranged to keep the pressure constant between each outer and neutral.

42. Q.—A certain length of three-strand cable is said to have a resistance of three ohms. If the three strands were separated and joined end to end, what would then be the total resistance?

A.—As the three strands of this three-ohm piece of cable are in parallel, it is obvious that the resistance of any one of them taken by itself is nine ohms. Therefore, if each of these strands be separated and connected end to end in series, the combined resistance of the series will be: $3 \times 9 = 27$ ohms.

43. Q.—An installation is supplied through a pair of conductors having a resistance of .015 of an ohm. The average load on the conductors is 40 amperes, and the total number of working hours per annum may be taken as 1,000. Calculate the energy lost in B.O.T. units per annum.

A.—The watts absorbed by the conductors will be: I^2R, where I and R represent the current and resistance respectively, or:

$I^2R = 40 \times 40 \times .015$, which quantity must be multiplied by 1,000 to bring it to watt-hours, and then divided by 1,000 to convert it to B.O.T. units:

Therefore the B.O.T. units will be:

$$\frac{40 \times 40 \times .015 \times 1{,}000}{1{,}000} = 24.$$

44. Q.—A V.I.R. conductor of section .007 sq. in. may carry current up to 24 amperes under the I.E.E. Regulations. Would a paper insulated conductor of the same size be considered good for the same current under the I.E.E. Regulations, or could it be used for a greater one? If so, by how much?

A.—The paper insulated conductor of the size mentioned is suitable for a current of 28 amperes, under the I.E.E. Regulations, subject always, of course, to voltage drop, this higher current density permissible being due to the difference of material with which the conductor is surrounded.

45. Q.—An alternating-current single-phase motor is supplied at 200 volts and develops 5 h.p. At this load its efficiency is 78 per cent. and its power factor is 80 per cent. Calculate the current taken.

A.—Multiplying the horse-power by 746, we obtain "watts." This divided by the voltage (200) gives current. Allowance will then require to be made for the efficiency and power factor as follows:—

$$\frac{5 \times 746 \times 100 \times 100}{200 \times 78 \times 80} = 29.8 \text{ amperes.}$$

46. Q.—(In this question, *output* is required to be found, given the *input*, efficiency and power factor.)

A single-phase alternating-current motor takes 20 amperes at 200 volts, and its efficiency and power factor are said to be 86 per cent. and 81 per cent. respectively. Calculate the b.h.p. developed.

A.—Multiplying the voltage and the current we obtain "watts," which is converted to horse-power by dividing by 746. Allowance will then be made for efficiency and power factor as follows:—

$$\frac{200 \times 20 \times 86 \times 81}{746 \times 100 \times 100} = 3.73 \text{ b.h.p.}$$

47. Q.—A two-phase, four-wire motor supplied at 400 volts is developing 24 b.h.p., and at this load its power factor is 85 per cent. and its efficiency 88 per cent. Calculate the total current and also the current per phase.

A.—B.h.p. (24) × 746 will give watts. This product ÷ by voltage will give current. Allowance will then be made for power factor and efficiency, as follows:—

$$\frac{24 \times 746 \times 100 \times 100}{400 \times 85 \times 88} = 60 \text{ amps. (nearly).}$$

This will be the *total current*, the current *per phase* will be: $\frac{60}{2} = 30$ amperes.

The "M.E." "1500 Junior" Receiver.

An Inexpensive and Simple Set for Everybody to Make.

By H. J. Barton Chapple,
Wh.Sch., B.Sc. (Hons.), A.C.G.I., D.I.C., A.M.I.E.E.

(*Continued from page 351.*)

I LEFT you last week at a most interesting juncture for all the components had been mounted in place, both on the panel and the baseboard. There may have been a few constructors who experienced a slight difficulty in reading the blue-print exactly, and there are one or two details which call for special mention. Do not forget to make a full use of the photographs which accompany these articles, as they enable you to visualise the wiring runs as well as component positioning.

Details to Watch.

With reference to the aerial coil, remember that the terminals 3, 4 and 5 are at the back and hence the rod operating the wave-change switch must be attached to the end *remote* from these terminals. Position the coil accurately by passing the rod through the panel hole made to accommodate it, but before so doing cut off the projecting portion of the ebonite bar at the back end of the strip. This is essential, otherwise it will foul the compression-type condenser when the switch is "pushed in" from the front.

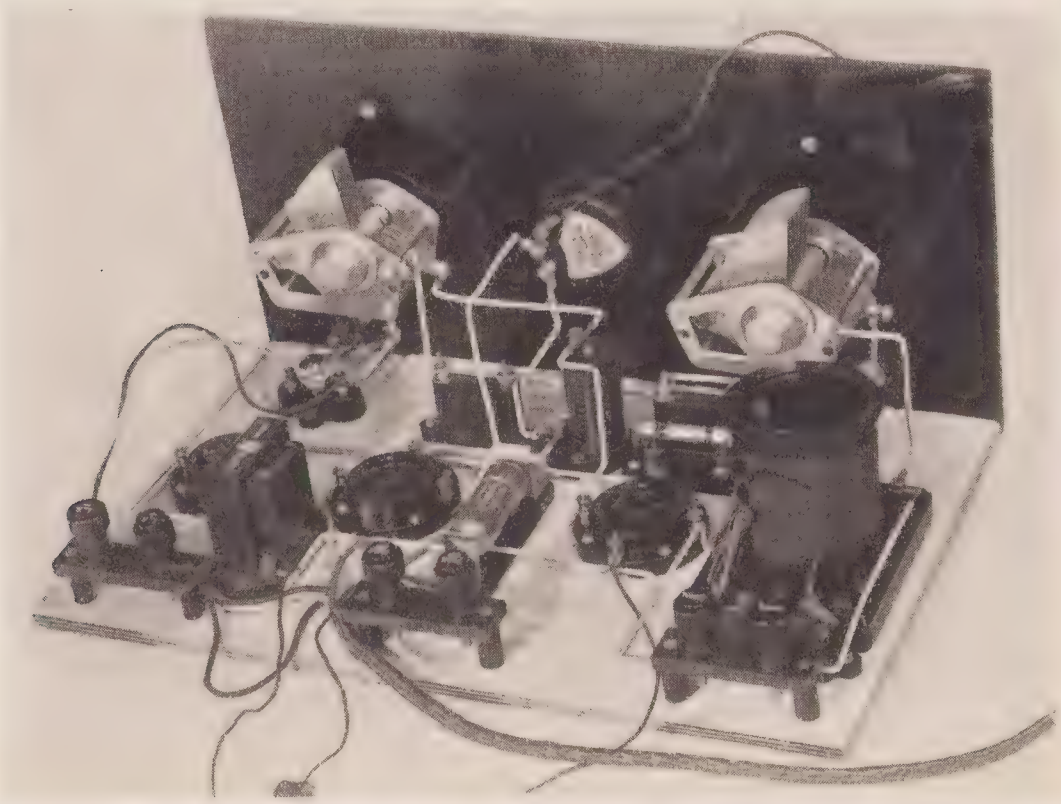
Notice how the three pairs of terminals are arranged on their respective strips with the lettering facing the panel. These terminal strips are raised ¾ in. from the baseboard by small ebonite pillars of the correct length, as can be seen from the accompanying photographs.

Other points to note are that the grid-leak holder clips are bent upright to take the grid-leak. This will allow the grid condenser to be mounted closer to the leak and keep the grid wiring shorter. In addition, I have included a couple of small dial indicators on the panel as this enables you to log condenser positions accurately when tuning in various stations.

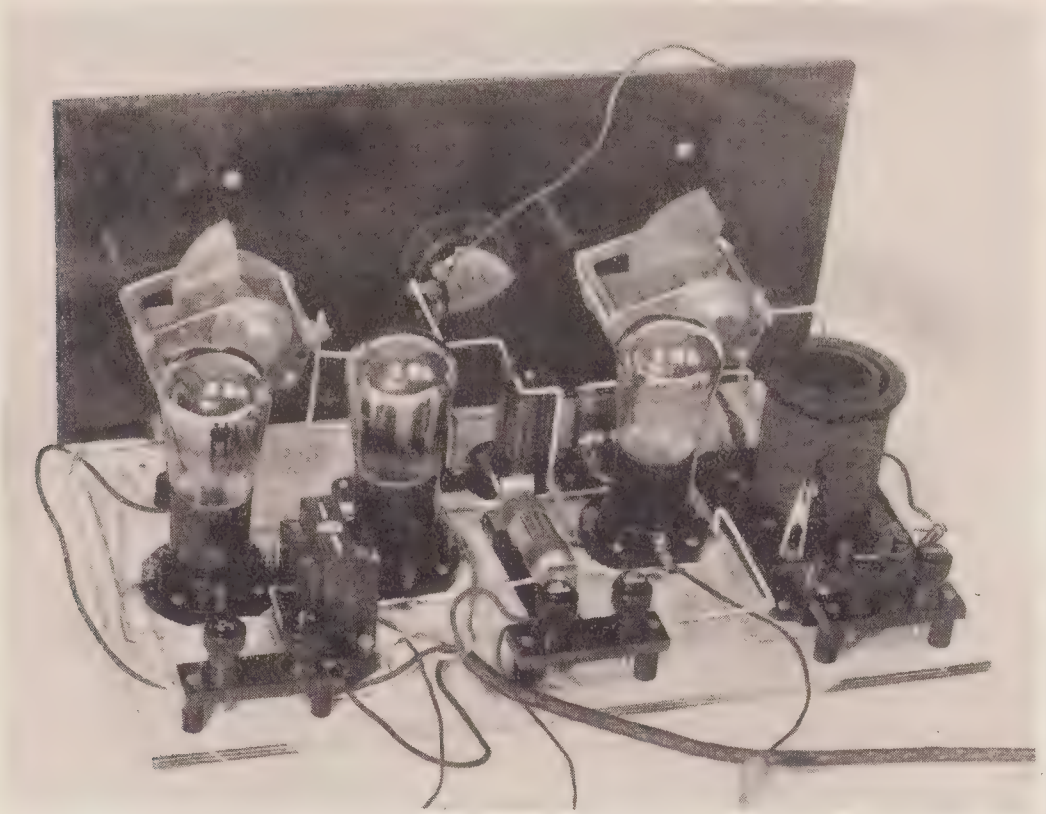
Start the Wiring.

Having checked up all the component positionings carefully, make a start on the wiring. This is very simple and straightforward, and should not take you long. I have used soldering tags under the terminal heads and soldered wires to them, but if you are not thoroughly at home with the soldering-iron, screw your wires under the terminals, after having first cut off the right lengths and looped the ends.

It is a good plan to remove the panel before starting and carry out as much of the baseboard wiring with this laid on one side. Then reattach the panel and complete your work. I have used a six-way battery cord for making the H.T. and



Note how the Terminals, Battery Cord and G.B. Leads are arranged.



The "1500 Junior" Set complete with Valves ready for its First Aerial Test.

L.T. battery connections, and two alternatives are open to the constructor. He can either buy the cord and plugs separately and attach them himself or Messrs. Belling & Lee, Ltd., will supply the battery cord complete with the leads at the set end cut off to the right lengths. The wiring diagram and photographs will enable you to see the six points at which connections are made to the set components, and be careful to tuck away any slack wire under the rigid Glazite wiring. This will keep everything tidy.

Take Great Pains.

As far as the grid-bias leads are concerned, do not cut them off short as the G.B. battery is housed inside the cabinet and it is better to leave the fitting of the plugs until the last when the set is inside the cabinet.

Take a pride in wiring up your set and avoid any "dry" soldered joints. See that the wires when crossing clear each other well and always make neat right-angled bends. Not only will the finished receiver then reflect credit on your constructive capabilities, but its performance will be improved in like proportion.

If you use the Glazite wire, employ a sharp knife to pare off the insulation at the junction points. Of course, if you prefer, bare wire may be pressed into service, but then I suggest that each wiring run be sheathed with systoflex insulation. Remember to lightly pencil cross-hatch on your wiring diagram each wire as you fit it in place, for in this way it will help you to avoid being guilty of "sins of omission." You will then check your work stage by stage and once every wire is crosshatched the wiring is completed. See that you have the right individual wire of the battery cord passing to the six points on the set and the corresponding H.T. plug or L.T. spade terminal at the other end. The separate colours for the cords assist you in this direction.

Preparing for an Aerial Test.

Before definitely housing the set in its cabinet I think you will find it a wise plan to give the receiver an aerial test. Should a fault evidence itself it can then be more easily remedied than would be the case if everything was rigged in the cabinet. Insert the anode resistance and grid-leak in their respective clips, screw home the fuse lamp in its holder and proceed to collect together the essential accessories for working with the set.

All the necessary components for making the set itself were given last week, although, strictly speaking, the cabinet and grid-bias battery should be included in this accessory category.

The Accessories Required.

In addition, we shall require a source of high-tension, and if you prefer dry batteries then it is really best to obtain two 60-volt units and join them in series. Of course, a 100-volt battery will do quite well, but there is less chance of distortion in the last valve stage if 120 volts is used and the negative grid-bias increased accordingly. The H.T. consumption of the "1,500 Junior" receiver is in the neighbourhood of 10 to 11 milliamperes, so to be on the safe side double capacity batteries are really the wisest investment, and those of Ripault's are admirable for this work.

For those who prefer a wet H.T. source apart from high-tension accumulators, then I can do

nothing better than recommend the "Standard" wet H.T. battery units. For low-tension choose a 40 to 50-ampere-hour accumulator of any well-known make such as Ediswan, Exide, Hart, Easticks, Oldham, etc. The voltage will depend upon your choice of valves, that is, whether they fall in the 2, 4, or 6-volt class.

Loudspeaker and Valves.

Coming to the loudspeaker the constructor must be guided by the extent of his purse. Economy and efficiency are combined in many makes now on the market, and the one we saw featured in last week's photograph is a Whiteley Boneham All-Bakelite Cabinet Model, and it works admirably with the set. Alternatively, the Whiteley Boneham unit, cone and chassis can be purchased separately and made up by the constructor himself. Another type which I have tried out with the set is a Wates "Star" loudspeaker unit and double-cone chassis, and this gives first-class results.

Finally, we come to valves, and here several alternatives are open to the choice of the individual. Again, in the interests of economy, however, I recommend 2-volt valves, but if preferred you can use the 4 or 6-volt equivalents. For the detector position use a Mullard P.M.1A., or Cossor 210 R.C., or G.E.C. H.210. For the first stage of low frequency we have a Mullard P.M.1L.F., or Cossor 210 L.F., or G.E.C. L.210, while for the last or output stage one of the following: Mullard P.M.2 or P.M.252, Cossor 215P, or 220P., G.E.C. P.215, or P.240.

Battery Voltages.

Place the chosen valves in their individual valve holders and join up the L.T. supply *first*. For H.T. voltages place the full 120 volts on to H.T. +3, about 100 volts for H.T. +2, and 80 to 100 volts for H.T. +1. These values are by no means rigid, and adjustments can be made on site to find those best suited to the valves chosen. However, the values suggested will generally be found to be of the right order.

Since G.B. −1 only comes into operation when using a pick-up, that does not concern us for the moment. G.B −2 should be about 3 to $4\frac{1}{2}$ volts, while G.B −3 about 9 to 12 volts. Remember that the larger the value of the negative grid-bias applied consistent with quality reproduction in your loudspeaker, the smaller will be the high-tension consumption, and this point should always be kept uppermost in mind.

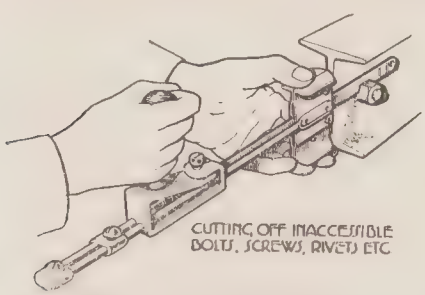
Now connect your loudspeaker and aerial and earth leads to the terminals so marked and everything is then ready for the first test. I feel it is wise to leave off at this juncture so that I can devote the whole of the third and concluding instalment to operating details. These are very simple and straightforward, and if you have completed your set, then no harm will be done if you try your own hand at tuning in one or two stations. Just bear in mind that the too prodigious use of reaction will cause interference to your neighbouring listeners so "please don't do it," as P. P. Eckersley was wont to say.

(*To be concluded.*)

New Tools and Wireless Supplies.

Two Novelties in Tools.

Our illustrations show two interesting novelties for the workshop. The first is a quick-action screwdriver which has a spring clutch device in the handle. The effect of this is to enable the screw to be inserted or withdrawn without constantly changing one's grip on the handle of the screwdriver. The latter can be operated in either direction. Pressure on the handle puts the clutch into gear for turning the screw, and when the pressure is removed the spring automatically releases the clutch, ready for engagement in another position for the next turn. Our other illustration



A Hacksaw for Awkward Jobs.

shows the "Ferret" hacksaw, which, as its name implies, is adapted for penetrating into awkward places where an ordinary hacksaw could not be used. The saw blade is guided throughout its stroke and, as the sketch shows, it may be used for jobs which ordinarily are difficult to get at. Cutting keyways in pinions and shafts is another use to which it may be put.

These ingenious tools are being marketed by

A New Type of Screwdriver.

T.W.S. Associated, Ltd., Bush House, London, W.C.2.

A "1,500 Junior" Set of Parts.

Messrs. Peto Scott & Co., Ltd., have been enterprising enough to cater for builders of our "1,500 Junior" wireless receiving set by putting up a set of reliable components at the price of £5. This set includes a cabinet, ebonite panel, baseboard, and all the principal components required for the set. One or two details such as the grid-bias battery, battery cords, plugs, tags, and station log indicator have been omitted to keep the price within the all-round figure quoted, and, of course, the price does not include valves or H.T. or L.T. batteries. We have examined a sample set and can recommend it as excellent value for the money; if desired, it may be obtained on the instalment payment system. Full particulars may be obtained from the suppliers, Messrs. Peto-Scott and Co., Ltd., 77, City Road, London, E.C.1, in whose window the set is exhibited.

SHOPS, SHED & ROAD

A Column of "Live Steam."

By "L.B.S.C."

The Unexpected Happens.

The next piston-valve engine to pass through my hands for "monkey-glands" was one I never in all my dreams expected to operate on. During the time I lived at Norbury I had, as you know, a big correspondence with brother loco men in Canada and the United States; used to get friendly chats about the big locomotives and their doings, along with snaps of engines and trains, and was also kept pretty well informed of the doings of the small locomotive world in the big Western continent. That was one reason, incidentally, why I had a friendly smack at Fred Grimke, for I was certain of my ground. One fine day I received a picture of a nobby-looking Pacific loco built in Chicago. She was a 3½-in. gauge outfit, but the width between rails was no guide to her actual size, for everything on her was equal to "one inch scale" or what would be fitted to a 4⅜-in. gauge engine. Cylinders were 1½ ins. by 2¼ ins., with piston-valves and Baker gear; 6-in. drivers, a huge boiler 6 ins. diameter at the smallest ring of the taper barrel, and a firebox big enough to roast a turkey. She was chock-full of blobs and gadgets; had two commercially-made injectors, working "drop" sand gear, steam brakes, rocking grate, and dickens knows what else. During the next fortnight or so, more pictures of the same engine arrived from different quarters, along with some wonderful tales of what she could do—one brother in Chicago who let his enthusiasm run away with him solemnly declared that her *actual* speed on the track was between 28 and 30 miles per hour! When 28 is, I believe, the present record for a 15-*in. gauge engine*, I guess the above statement needs no further comment. Well, I duly took note of this record-breaking Pacific, thanked my correspondents, filed the pictures, and very soon forgot all about her.

Some Surprise!

One morning when I was busy in Mr. Holt's shop, a little auto-truck drove up, and delivered two locomotives, sent to Mr. Holt by a friend of his for a few repairs. Being inquisitive, I got the larger one of the two out of its crate, and thought somehow it seemed familiar, so routed out the few photos I had left, in search of a clue to its identity. I was not mistaken—the engine before me was the one whose pictures I had received in London, and a few judicial enquiries later on confirmed it. One glance at the tops of the combination levers told me pretty plainly that the locomotive, far from being able to do thirty miles per hour, would have a dickens of a job to manage *thirteen* without draining the boiler of steam in a few seconds, and blowing all the fire up the smokestack. Mind you this: the engine herself was a good all-round job from a mechanical and "workmanship" point of view; but the builder was a much better mechanic than a locomotive engineer, and the engine was lacking just those fine little points which are essential if you want to combine power, speed and efficiency.

Mr. Holt gave me his friend's list of the jobs requiring attention, and amongst them was "examine valves and pistons"; that was enough for your humble servant. I examined them all right, and found the pistons not so bad, although blowing slightly. But the valves—oh, gee! Little baby steel piston-valves in "brass" bushings; nicely made, well fitted, but the size—barely 7/16th in. diameter and approximately ⅜-in. stroke for the big cylinders mentioned, which wasn't nearly enough. In addition to that, the collars securing the piston-valves to their spindles were so jolly big they nearly filled the bores and only left a little annular space for the steam to escape, even when the exhaust ports were fully open. Both Mr. Holt and myself were curious to know how she behaved under steam, so we did the rest of the jobs, which included altering the lubrication for proper hydrostatic action with separate steam feed from the boiler, and then we tried her out on the track without disturbing the original arrangement of valves, nor altering the timing. Well, she turned out just as we thought she would—ran as "Woolly" as an Australian sheep, got up to a certain speed and would not go any faster (certainly not thirty miles per hour), and ate up the coal and water like a griffin. The acceleration was poor with a load, and there was a good heavy blast even when she was running light, sure proof of late timing. There was only one thing to be done, and I did it.

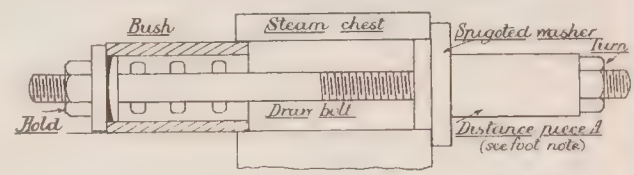


Fig. 1.

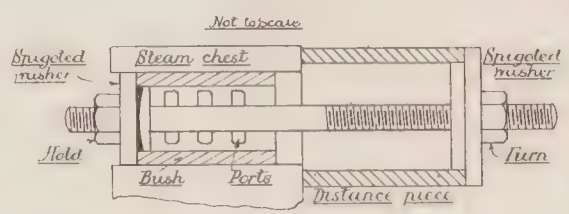


Fig. 2.

Device used for Withdrawing and inserting Valve Bushes.

Another Combination Tried.

The cylinders were, of course, cast iron in this size, and the steam-chests had been truly bored, the valve bushings being forced in. I wanted to get the bushings out without damaging them, as I had it in mind to rebore them and use again if they would admit of it, so made a gadget which did the job and is shown in sketch, which needs no explanation. Incidentally, the bushes when finished were replaced safely without any distortion with the same weapon. The spigots on both the draw-out washer and the one which takes the pull at the end of the steam-chest, want to be a fairly good fit in their respective bores, otherwise you stand a chance of pulling the bushing on the skew-whiff and spoiling it for further service. Also, when replacing bushes, the distance-piece should fit on the draw-bolt and have truly faced ends, for the same reason. A good wheeze is to make a few short distance-pieces, bored and faced, and use them (as you would the collars on a milling-machine arbor) to make up any required length, and then you're all set for any old job which happens along. Never shy at making a special tool or gadget if you can possibly spare the time. I gave away a huge box full of blobs and gadgets when I left the old place at Norbury; have sadly missed them, and am now accumulating another collection.

Anyway, when the bushes came out, I found they would stand boring to $\frac{3}{4}$ in. diameter without unduly weakening them. They were some kind of yellow metal, not brass nor screw-rod, but a sort of yellow bronze, easy to machine and taking a nice finish. I would have preferred good red phosphor-bronze, but hadn't a piece large enough to make up new bushes. Mr. Holt has a 6-in. four-jaw Union combination chuck on his small South Bend lathe, so I carefully set up each bush dead true in that, and bored and reamed them to $\frac{3}{4}$ in. in exactly the same way I should have operated on a pair of cylinders. The result was perfectly circular glass-like bores. The original ports were round-ended slots, four at either end; these were lengthened out with a rat-tail file, the reamer again put through in case there happened to be any burrs left, and that settled that part of the business. The bushes were replaced after the valves had been made to suit. The next disturbance in the brainstorm department was what to use for piston-valves. I wanted rustless steel, but we hadn't any big enough, so Mr. Holt routed around, found some cast-iron sticks, and suggested using valves made of that material. Well, I have had some experience with cast-iron bearings and always found that after running some time, they glaze, and the wearing surface becomes sort of case-hardened. I didn't see why the same thing shouldn't happen to properly-fitted piston-valves, and give a long wearing life whilst remaining steam-tight. Cast-iron valves have been used in America on small engines before; but I have seen the handiwork of one or two makers, and in one case especially the valves leaked very badly, due to the bobbins being of oval section and letting steam flow past. To all intents and purposes they were tightly fitted to the bushings but "didn't touch all around," so it was no fault of the metal wearing unevenly.

Making Cast-iron Valves.

Iron castings often have a sort of "surface porosity." When you machine off the skin, you usually find that for about 3/16th in. or so under it there are tiny blow-holes and pin-holes, and therefore when making patterns for cast-iron cylinders it is advisable to use smaller core-prints than you would for bronze castings. This allows the fine close-grained metal to be reached by the boring tool before applying the finishing reamer. It was for the above reason I chucked a piece of cast bar $1\frac{1}{4}$ ins. diameter and turned the $\frac{3}{4}$-in. piston-valves from it. They were roughed out to about five thousandths over finished size, the cross-slide fed in one division at a time and successive cuts taken until the bushing would go over the end a very tight fit, and then the cutting tool was traversed once or twice over the job *without setting the cross-slide in any more*. This gave a nice finished surface, and the bobbins were as round as a lathe will turn them. They just exactly fitted the bored bushings when dry, and the application of a drop of oil made them work "sticky," so you can guess they were a close fit. They were drilled 7/32nd in. to fit over a 3/16th-in. valve spindle, so that in case of any inaccuracy made by the original builder in drilling the covers, they would "float" and work freely. After parting-off, each valve was mounted on a spindle and run at a high speed, the bushing being moved back and forth over it, and more oil applied to stop it running hot and seizing up. A few minutes of this treatment polished up both the surface of the bobbins and the bore of the cylinders; they ran quite free and yet were steam-tight.

The original valve spindles were brought into use again, the overall length of the valves being arranged to exactly fit the space between the driving collars, and the bobbins were slightly stepped at either end to give the necessary 1/32nd-in. exhaust clearance.

Alterations to Valve Gear and Timing.

I gave the valves $\frac{1}{8}$-in. steam lap, and as the ports were a little over $\frac{1}{8}$ in. wide, that made each bobbin had to be $\frac{1}{4}$ in. full in length and needed a swing of a full $\frac{1}{4}$ in. at the top of the combination levers. This meant having the pins *twice as far apart as they were in the existing levers*, and the latter weren't long enough to allow for it. As time was precious and did not permit of making new levers altogether, the tops of the existing ones were sawn off just below the bottom pin-hole in the forks, and small chunks of steel bar brazed on with brass wire instead of spelter. I guess you'll laugh some at my constant reference to sticking bits on here and there, but I do really assure you that hours and hours of laborious filing, turning and sawing can be saved by the judicious use of the brazing gadgets. Mr. Holt has a little acetylene torch, quite a tiny affair, which blows of itself and needs no separate oxygen supply—you just turn on the gas, light the jet with a match, and you're all set. I christened this little fellow the "putting-on tool," and it does the doings right nobly. However, to switch back again, the new chunks on the levers were filed up, slotted and drilled to give the required swing, and the main valve gear readjusted to permit the valves to travel a full $\frac{1}{2}$ in. in full gear.

Timing was very simple. On checking over

4—6—2 Chassis of 3½-in. Gauge Piston Valve Pacific built by Frank Birch.

the lengths of eccentric-rods by putting each main crank on dead centre and swinging the reverse lever, it was found that the eccentric-rods were a little too short between centres. They were something like small main connecting-rods, with a regular big-end brass in each; so the brasses were shifted further along the buckle and new wedges made, which did the trick fine. When the lever could be swung from forward to backgear without the valve spindles moving any, on either dead centre, a tyre pump was connected to the boiler feed pipe, a few puffs of air put in, and the throttle and cylinder drain cocks were opened. Each crank was placed in front dead centre and the valve spindle turned until a slight hiss was heard from the corresponding drain cock, showing the port was opened to lead. Timing was then correct, and the locknut on the valve spindle tightened well up. The engine, which alone weighs some 180 lbs. in working trim, would wheel herself up and down the bench with less than 5 lbs. of air showing on the gauge, so we passed her off O.K.

Some Track to Test On!

You can't get a satisfactory trial of a 3½-in. gauge engine which is really speedy and powerful on a small line; so, by kind permission of Mr. Astor, the engine was tested out on his line at Rhinebeck which, as you know, is nearly a mile long. It meant an automobile drive of ninety miles each way; but this isn't much over smooth concrete track highways where there are no ridiculous restrictions to bother about; and when most of the time you can see about a mile ahead, and there are coloured stop-and-go signal lights at all cross-roads, you can hop along at a tidy speed and still observe every "safety-first" rule in the book. Anyway, we loaded up the old cat on Mr. Holt's Chrysler auto. and sallied forth to do or die. We landed safe and sound, and while she was getting up steam, three fifty-pound bogie flat cars were coupled up, and two of them loaded with lengths of full-size rail, about 600 pounds in all, and this, plus the weight of the cars and Mr. Holt and myself, was the load we gave her for test. After a short preliminary warm-up we started off in fine style, the engine showing good acceleration with fine sharp snappy exhaust beats, although she only carries 75 pounds of steam, the boiler not being considered safe for a higher working pressure. However, it was good hot steam—I had fitted a five-element spearhead type of superheater, the ends of which reached within ½ in. of the firebox, and the only time any exhaust was visible at the smokestack was when the injector was inadvertently left on too long and the overfilled boiler began to prime. As soon as the cylinders got properly hot, she went like a Twentieth Century, Wolverine, Southern Belle, and Cornish Riviera all rolled into one, with the lever in the next notch to midgear and the exhaust dying down to a purr, fire just a dull red and hardly using any water. After about a couple of miles like this, excitement began to bubble up, and Mr. Holt who was driving, opened her out at the foot of the long one-in-a-hundred grade. Up went the sparks, she started blowing off, and sailed up the grade with the thousand pounds odd behind her tail, rapidly gathering speed until she reached the switch at the top, where she promptly jumped the track and turned over on her side, lying at right angles to the road. Mr. Holt fortunately had hold of the throttle handle as she left the rails, and slammed it shut; the next instant he was slung right over the top of the engine as the train telescoped and the 5/16th-in. drawbar between engine and tender snapped like a carrot, the tender running off to one side. The heavy load of rails on the two cars kept them on the track despite the sudden stop; but the first car, on which I was riding, tipped up and decanted your humble servant in a dusty heap alongside the wreckage. It was the finest imitation of a real railroad smash I've ever been in.

Well, I guess we didn't know whether to laugh or cuss. Anyway, both of us were chiefly concerned about our baby, who was lying on her side with the wheels just turning. We stood her up and got her on the track again; and I assure you, brothers all, one hundred and eighty pounds of hot locomotive wants careful handling! She was not damaged except for a dented boiler lagging plate and a bent hand-rail with two knobs turned off; so we made a temporary coupling from some strands of iron wire, connected up the water pipes, re-railed the rolling-stock, wiped all the ballast off the motion, and proceeded on our way at a more decorous speed. Later in the day the "superintendent of the line," our friend the ex-Pennsylvania official, came along with his little boy and a lady, and added a few more pounds to the train. With this extra load, the engine started from a dead stand-still on the other side of the one-in-a-hundred grade, accelerated up the bank and started blowing off before she reached the top. We kept at it till it was too dark to see the track any more, and after a hasty pack-up, wash, and a bit of food, faced the ninety-mile drive home. After an inadvertent detour by which we lost a few miles.

we landed home safe and sound, tired but happy, very near midnight. Such is the grip which *real* miniature railroading gets on any guy who loves a locomotive.

I am sorry that the promised pictures aren't yet available, but not having found the American equivalent of Messrs. Crompton, Stevenson, or "Bill Massive," our flashlight close-ups have not so far been suitable for reproduction. However, all isn't lost yet! Meantime, here is a picture of a 4—6—2 chassis of similar type to the one mentioned above. It was made by Mr. Frank Birch and has piston valves of pretty much the same kind as I fitted to the Chicago-built engine. Providing that the job of making and fitting is carried out properly, internal-admission piston-valves are much superior to flat valves on 3½-in. gauge engines, as you can get tremendous ports, straight steam passages, and hardly any strain on the valve gear.

Model Aeronautics.

Some Suggestions on Setting about Model Aircraft Designing.

By J. Van Hattum.

IN my previous article I gave a few notes upon the behaviour and action of an aeroplane's wing in free flight. Some may be of the opinion that there was an abundance of technical terms and a certain amount of *x y* chasing. Actually, there was as little ornamental mathematics in it as possible, and what was given was not thought to overtax the brain. Still, one was told that some people, upon encountering certain equations, uttered a wicked word and flung the paper into space; which is not the way to set about reading an article, and, anyway, articles are supposed to bring something new. One must confess, however, to feel a little sympathy with those impatient with theoretical data which do not bear upon the subject. The elegance of fragile formulæ is left to those desiring it, but it must be remembered that, essentially, the prescription is the same as the mixture.

General Considerations.

In this article it is proposed to deal with the design of model aeroplanes seen from the drawing-office rather than from the workshop. Valuable hints concerning the construction of the parts making the model have been given in a number of articles and more are to appear. It is thought that some information on the groundwork that has to be done to produce even the smallest model would be of some help. We will confine ourselves to the tractor fuselage model which is at the present time the most popular, although one is of the opinion that it is not the most interesting type.

The tractor fuselage model is almost without exception of the monoplane type, and the wings are nearly all of the cantilever variety. Thus there is little sense in regarding models according to their layout and appearance, and a classification for weight seems to allow for greater accuracy. We have then:—

The lightweight general-purpose model up to 5 ozs.

The lightweight duration model up to 5 ozs.

The middle-weight general-purpose model from 5 to 10 ozs.

The middle-weight duration model from 5 to 10 ozs.

The heavy-weight model over 10 ozs.

The duration type of the last class has been left out because, although duration is the chief aim, its performance is not, generally speaking, comparable to those of the other two classes. It is admitted that a 12-oz. machine is not really heavy and might quite reasonably put up a record, but any classification is necessarily a little unfair when taking examples which are on the border-line. Usually, a heavy rubber-driven model is designed for other purposes than breaking a duration record.

We will now regard the principal features of these types. The light-weight general-purpose model is the best to begin with if one has never built a model before. It is of very simple design and the great advantage is that it is so light that it cannot smash itself in a rough landing. A description and drawings of a small model designed by Mr. Pelly Fry has appeared recently, and we will therefore not deal with it in detail. A wing-loading of 5-7 ozs. per square foot is most likely to prove successful as it makes for a small wing and sufficient speed to ensure effectiveness of rudder and tail-plane. The duration with two skeins of rubber is practically equal to record duration a few years ago, viz., 40-50 secs.

Light-weight Duration Models.

The light-weight duration machine is generally very much similar to the previous type as far as appearance is concerned. But here weight-saving and external refinement in the form of fairings and streamlining have been really carried to a fine art. This makes it possible to obtain a lower wing-loading for the same size of wing. Whereas longerons, wing spars, etc., of the general-purpose machine may be of ⅛-in. cross-section for a length of 24 ins. these are sometimes reduced to 1/16th in. square and less in some duration planes, especially if many spars

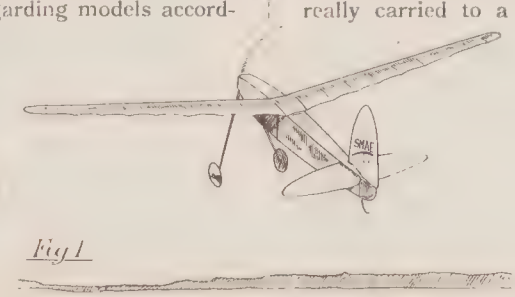


Fig 1

High Performance Model Taking Off.

are used. Even these extremely small sections do not seem to constitute a limit as far as structural strength is concerned, as the machines stand quite a surprising lot of throwing about, and, at the worst, suffer a broken longeron or so. The main reason why these models should be left alone until one is sufficiently at home in the construction is that the parts are of such small dimensions as to be rather difficult to handle. Great care is necessary or the pressure of one's hands is more than the structure will stand. One saw a wing being built by somebody who is quite an expert at the job, and a beautiful piece of work it was. Its spars were slightly over 1/32nd in. in cross-section, but after covering and doping this wing was so distorted as to evoke the mirth of anyone who saw it. Its performance, however, contrary to all theory, was just about as good as the best conventional wing one has seen. The next wing built by the same designer had much stronger spars, merely to withstand the strain of the dope. It is advisable to use the diluted variety of the commercial dopes on all structures which are rather weak in the uncovered state, but the dope should possess sufficient strength to produce a drum-like surface. This diluted dope is the kind supplied by most firms specialising in model aeroplane materials. The structures of small and light models may be extremely weak and easily twisted as the covering and dope add considerable rigidity. If the structure is perfectly strong in every respect before covering, it is really too sturdy, and the extra strength of the covering has not been used efficiently. Owing to their small weight, low loading, large propeller and high power-weight ratio, both types of this class give remarkably good performances, especially in climbing.

Medium-weight Models.

The middle-weight models form a very interesting class. The distinction between the two types, general-purpose and duration, is mainly the same as explained for the previous class. To the duration-type belongs Mr. T. H. Newell's "Falcon," which at present holds the duration record with 85 secs. flight. It is a plane of remarkably clean design, fairly straightforward but modern in every respect. It weighs about 9 ozs. complete with rubber. Another outstanding type of this class is Mr. R. N. Bullock's low-wing monoplane which secured the Wakefield Cup in last year's international contest at Halton. These two examples clearly show that one need not necessary build very small and extremely light machines to obtain good performances. The objection to the duration type of the light class, viz., difficult construction, does not apply here, as in the larger machines the parts are necessarily more robust, and the chief difference between the general-purpose and duration type consists mainly of refinement in detail design and lower wing-loading of the lafter. By having two interchangeable wings one can fly the same machine for ordinary work and duration.

The Heavy-Weights.

The heavy-weights are a class apart from the previous ones if they are really heavy. They are naturally large machines and their behaviour is quite different from the lighter types. They are slow to take off and their flying is much more like that of a full-size aeroplane. Owing to the weight, however, a bad landing often results in disaster. As far as construction is concerned one may say that they are *the* type for those who like to display their ingenuity in detail-design. It is rather a pity that so few are seen flying nowadays. Whereas the rubber-driven model is heavy and big simply because its designer wants it to be so, the compressed-air driven model has to be large on account of its plant. Its high cost and the work involved in the construction make it a job for the more experienced, and the beginner should not let himself be tempted to choose it as his first model.

A Little Assistance.

The first thing anybody seriously interested in aeronautics should do is buy every aeronautical paper he can get hold of. One assumes that he is a subscriber to The Model Engineer. Quite interesting articles on model flying and construction also appear in the monthly journal of the S.M.A.E., information about which can be obtained from the secretary. The information given in the technical papers is of a general nature and in most cases relates to full-size aircraft. But they will be found to supply suggestions which, if properly converted and used, will be of value to the aeromodellist. Although the fathful reproduction of constructional methods and details as used in full-size work will only meet with failure, the general principles may be quite adaptable. A model built to scale from a full-size design will usually not be successful even if it flies at all. There are few full-size machines which seem likely to make successful models without considerable modifications, the only type being some low-wing monoplanes, more particularly the single-engined Junkers, and also the Fairey monoplane.

The Choice of Type to Build.

I strongly advise the beginner to build his first model from some well-known design, as it enables one to start with the accumulated experience of others. Having flown this machine a good deal, experimented with rubber motors of different powers, he will develop his own ideas about it, and these should then be laid down in a design of his own.

Having more or less mastered the fundamental principles of aerodynamics, he will know how to group his weights most efficiently around the centre of gravity. Before anything else is done, however, he must make quite sure about the type of machine he is going to build. After deciding upon the class, he has to compare the various merits of different layouts, such as high-wing monoplane or low-wing monoplane, lightly loaded or moderately loaded, large or small. There is little point in insisting upon one's own favourite type, because this is largely a matter of prejudice, having built it for a long time and become more familiar with it than with any other. The main point to observe when aiming at duration is that a lightly loaded model has a very good chance. Firstly, the light loading makes for good climbing and therefore a long glide after power has run out; secondly, because it flies at slow speed and does not need to have a fast-running engine. This allows for less rubber and hence more turns. This does not imply that a model with a heavier loading has

no chance. The main drawback to very slow machines is that we can very seldom find a day quiet enough to obtain maximum performance. The heavily-loaded model in the hands of Mr. Plater, of Halton, has repeatedly given proof of being indifferent to theoretical disadvantages and almost daily puts up durations of a very high order. So we leave the choice of type entirely to the designer, who will soon take a personal fancy to a particular formula.

There are the problems of shapes and proportions which may easily be an obstacle for the beginner to produce an original design and induce him to copy rather than risk failure. Comparatively little can be said about it here, firstly because it is too comprehensive a subject, and, secondly, because only little is of use to the aeromodellist. The main thing the beginner should guard against is that his first design should not be *too unconventional*. If he tries a pusher fuselage monoplane, either with tail-booms or with tail in front of main wing, he is perfectly safe, even though he may quite conceivably fail. But if he gears four propellers to one rubber motor he is merely wasting his time. If he has an idea that seems worth while, let him think about it for a few days, work it out in his mind, and if he is still convinced of its value, let him build it.

(*To be continued.*)

The Model Aircraft Club.

A most successful and enjoyable meeting was held by the Model Aircraft Club on Wimbledon Common on Saturday, April 5. The "Gamage" Cup was competed for, and the Club's competition took place.

Although the weather was dry, the damp atmosphere was not altogether conducive to a high standard of efficiency, but, even so, most members put up a wonderfully good performance.

Results.

Fuselage Competition.—1st, Mr. A. T. Willis, 45 secs.; 2nd, Mr. Welding, 41 secs.; 3rd, Mr. Englefield, 33 3/5th secs.

Spar Competition.—1st, Mr. Pavely, 97½ secs.; 2nd, Mr. Wilkinson, 66 secs.; 3rd, Mr. Holt, 49.2 secs.

Ladies' and Junior Competition.—1st, Mrs. Willis, 45 secs.; 2nd Master Willis, 35½ secs.; 3rd, Master Walker, 18.2 secs.

Mrs. Ralph White kindly presented the prizes on the field, and the winners were delighted with the lovely little clocks and cameras which they won.

A large crowd of enthusiastic spectators assembled, and it was not until it was quite dark that the meeting ended.

At the time of writing an Aerial Golf Competition will be held on Wimbledon Common for the K.M.A.A. Cup on April 12, and a report of the proceedings will be given in due course.

Hon. Secretary, A. E. Jones, 48, Narcissus Road, West Hampstead, N.W.6.

The Annual Exhibition of the Chicago Society of Model Engineers.

FROM November 13 to 16 last, the Chicago Society of Model Engineers held its twelfth annual exhibition of models, tools, etc., in Room 1,006, Republic Building, 209, South State Street, Chicago. As in former years the exhibit was open from 3 to 10 p.m. daily and from noon on Saturday, free to the public.

An apparently growing interest on the part of the daily Press was shown in the general allowance of space for articles in the exhibit. *The Chicago Daily News* printed nearly a column of descriptive matter regarding the show, and the following day printed several pictures of models. This quite unusual amount of publicity resulted in a very good attendance throughout the period of the show. It was interesting to note from casual conversations with strangers, visitors at the exhibit, that many, on being asked, admitted that at some time or another they had either made or tried to make a model of some kind, thus proving that model-making has touched a larger part of the general public than the average model-maker supposes.

All steam models that were in working condition were operated on compressed air piped along in back of the stands, thence by means of rubber tubing to the individual models. One of the photographs shows the track upon which

[Two Views at the Chicago S.M.E. Exhibition.

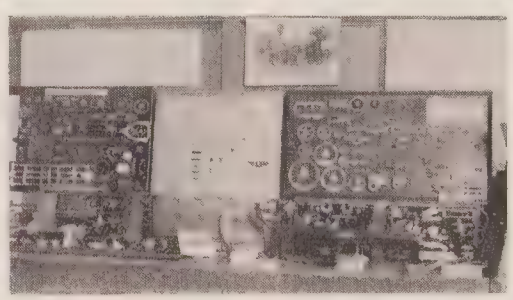
Some of the Ship Models at the Chicago Exhibition.

Mr. Matthews's ¾-in. scale model Atlantic locomotive made regular trips under air pressure.

No competitions were held, except what might be termed a popularity contest. Visitors, but not members, were invited to cast a ballot to indicate which model, among those shown by members of the Society, they "liked best," the winning model to be sent to represent the Chicago Society of Model Engineers at the exhibition by the New York Society of Model Engineers in New York, and to receive a prize to be determined by the Exhibition Committee. Quite frequently a vote of this character may mean nothing as regards the quality of model selected, but in this case, judges taking into consideration every factor, would have had a difficult task to select a better representative model from among the exhibits, than John Matthews's ¾-in. scale model Atlantic locomotive, which performed so well at THE MODEL ENGINEER Exhibition in London in 1928, and which was the winning model in the present instance.

The trade section was a new feature with the C.S.M.E. It included exhibits by H. J. Coventry, of Baltimore; the Ata Manufacturing Company, of Chicago; the Model Boat Works, of Stamford, Connecticut; Stebbins Hardware Company, of Chicago; Frank Birch, of Detroit, Michigan; and the Chicago Branch of the Goodell-Pratt Company.

Among the railway models were a set of finished cylinders and parts for a ¾-in. scale model Pacific-type locomotive, and a finished ¾-in. scale model of Richard Trevethick's locomotive, by E. L. Hayward; ¾-in. scale Atlantic Locomotive, by J. Matthews; ½-in. scale model steam outline, electrically driven locomotive, by J. W. Keenan; ½-in. scale model German-type locomotive, by J. Baur; ½-in. scale model electric locomotive, by S. C. Swanson; ½-in. scale model caboose, by J. W. Keenan; ¾-in. scale model 4—4—0 type Chicago Great Western locomotive, by Bion J. Arnold; 1¾-in. gauge Atlantic locomotive (unfinished), by J. Matthews; a group of model British goods wagons, made by J. Jones; small cardboard model L.N.E. Railway locomotive, loaned by R. Matthews.



Locomotive Parts and Castings.

Steam models other than locomotives included a ¾-in. by 1¼-in. by 1¾-in by 1¼-in. stroke triple expansion engine, by J. Baur; 1⅛-in. by 2-in. horizontal engine, by P. Reithmaier; 1-in by 2-in. horizontal engine, by C. J. Musser; 1⅛-in. by 1¾-in. horizontal engine, by S. C. Swanson; small power house with engine and vertical boiler with automatic feed water control, by H. Beddoes; ⅝-in. by ¾-in. vertical piston-valve engine, loaned by C. J. Musser; a group of engines showing the development of the steam engine from oscillating engine to two-cylinder single-acting engine and turbine, by J. Matthews; unfinished marine water-tube boiler, by J. Baur; gas-fired vertical boiler, by S. C. Swanson; gas-fired vertical boiler with steam feed pump, by J. Matthews; speed boat engine parts, by H. Beddoes.

The boat section was well represented by a number of exhibits, including a model schooner yacht, *Josephine K*, by Geo. Huss; model of *Old Ironsides*, by H. J. Brabec; ⅛-in. scale model brig-of-war of the period of 1812-1830, by Wm. Tobin; model of bark *Morning Star*, by Dwight Arthur, loaned by Val. E. Funke; model Spanish galleon, by H. J. Brabec; model first-class battleship, by H. J. Brabec; framework for model speed boat *Miss Margaret*, by T. A. Ahlsgaard; model steam launch, by J. Matthews.

Other models included framework for model of DH4 airplane, by T. A. Ahlsgaard; model five-cylinder airplane motor, by T. A. Ahlsgaard; model airplane, by E. Szymanski; 1-in. scale model steam roller and 2-in. scale model steam traction engine, both by J. Matthews; a collection of surface-gauges and other items of fine tool-making by L. Fahrenwald.

Arrangements for and management of the exhibition were under the direction of E. L. Hayward, the chairman of the Exhibition committee.

Full particulars regarding the activities of the Society or details as to requirements for membership, may be had from the Secretary, S. C. Swanson, 5501, West 64th Street, Chicago, Illinois.

For the Bookshelf.

Motorists' Electrical Guide. By A. H. Avery, A.M.I.E.E. London: Sir Isaac Pitman and Sons, Ltd. Price 3s. 6d., postage 3d.

The electrical features of a motor-car are probably those which the average motorist knows least about. He is usually well posted on the details of engines, carburettors, and gears, but of the mysteries of the starter, or the magneto, or the lighting equipment he knows but little. Here is a book which will put him wise, in a very simple and instructive fashion. It first gives a general explanation of the fundamental principles of electricity and magnetism, and the generation of electricity, and then explains in detail the working of accumulators, magnetos, coils, lighting equipment, starters, electric horns and screen-wipers, and the other electrical accessories of the modern car. A glossary of electrical terms makes a useful and appropriate appendix. The author, Mr. A. H. Avery, is well-known to our readers as a sound exponent of electrical practice, and his latest book may be thoroughly recommended.

The Electric Wiring of Buildings. By F. Charles Raphael, M.I.E.E. London: Sir Isaac Pitman & Sons, Ltd. Price 10s. 6d., postage 6d.

This is another addition to a branch of electrical literature which is already a little crowded, but in the writing of text-books as in other occupations there is always room at the top, and Mr. Raphael has certainly produced one of the best books we know on the subject indicated by his title. In his preface he says, "I dare even hope that I may be able to convince a few casual readers in the more magnificent branches of the electrical industry that there is more in electric wiring than they thought there could be." Having thus warned his reader that electric wiring may possibly be regarded as a very serious and complicated business, Mr. Raphael proceeds to disillusion him by expounding the subject in a delightfully simple and straightforward manner. Serious the subject is, of course, because well-planned and well-installed wiring is of the highest importance in the efficient use of electrical service, but Mr. Raphael robs it of its difficulties by the exceedingly well-informed and competent treatment he gives. The good name of electricity depends so much on the safety and the certainty with which it is distributed, that this excellent guide to good wiring is really very welcome.

The "Practical Engineer" Mechanical Pocket Book. The "Practical Engineer" Electrical Pocket Book. London: Oxford University Press. Price 1s. 6d. each. Postage 3d. each.

These companion pocket books are both well-known for the practical and useful nature of their contents. In the 1930 edition of the former new notes have been added on steam traps, reducing valves, steam control valves, water-tube boilers, and Diesel and other oil engines. The 1930 electrical pocket book includes fuller information on cinema lighting, and has been revised and improved in other directions. A useful feature of both books is a buyers' guide and technical dictionary in French, Spanish and Russian.

A.B.C. of Television. By R. F. Yates. London: Chapman & Hall, Ltd. Price 10s. 6d., postage 6d.

Mr. Raymond Francis Yates is well known across the Atlantic as a writer on popular scientific subjects, and he tells the story of the development of television up to a recent date in a very interesting fashion. A good deal of the information given relates to experimental work carried out in the Bell Telephone Laboratories, which gives the book a real technical foundation. A chapter on making a television receiver will appeal to the amateur experimenter. As a general introduction to the lines along which the problem of television is being investigated by competent workers, this volume has much to commend it. The numerous illustrations are particularly well prepared.

Calvert's Mechanics' Almanac, 1930. Manchester and London: John Heywood, Ltd. Price 6d., postage 2d.

This annual, now in its 56th year, represents excellent value to the practical mechanic. It gives 190 pages of useful workshop and power-plant information, including a number of illustrated descriptions of workshop gadgets and methods, and a range of valuable reference tables.

"Mechanical World" Electrical Pocket Book. Manchester: Emmott & Co., Ltd. Price 1s. 6d., postage 3d.

The 1930 edition of this book has been entirely revised in its section relating to lighting circuits and switching, and much of the other matter has been rewritten and extended. New contributions relating to heavy electrical engineering are also included. It is an excellent hand-book.

Electric Overhead Travelling Crane Design. By W. A. Barson. London: Crosby Lockwood and Son. Price 15s. net. Postage 4d.

This is a handbook for the specialist interested in the competitive design of electric overhead travelling cranes. It deals with the general considerations in design, and with details of bridge construction, hoisting machinery arrangement, limit switches, electrical equipment, wiring and load attachments. Some useful tables and charts relating to dimensions, weights, loads and hooks are given at the end. It is a good guide to modern electrical crane practice.

Locomotive Engineer's Pocket Book, 1930. London: The Locomotive Publishing Co., Ltd. Price 3s. 6d., postage 3d.

Although this work is primarily intended for the professional locomotive engineer, it is packed full with interesting and informative details of locomotive and railway practice which must appeal very strongly to every railway enthusiast, and to the railway and locomotive modeller. In particular, the tables and outline drawings of the principal locomotive types make it exceedingly useful for reference.

QUERIES and REPLIES

Querists must comply with the Conditions and Rules given with the Query Coupon in the Advertisement Page of each issue.

Selections from Queries recently replied to.

3606. Making a Multiple-Voltage Transformer.—T. G. M. (Leicester).

Q.—I am charging accumulators of various sizes and require to convert the alternating current from the mains by means of a valve rectifier to enable anything between ½ ampere and 6 amperes 15 volts to be obtained, through the medium of a transformer. As I would like to make the transformer myself, will you kindly advise as to the best dimensions of core and the windings?

A.—The problem is rather complicated by the fact that it is desired to work the transformer from various primary voltages, such as 100, 200, 220 and 240, while still preserving the 15-volt output from the secondary. It is proposed to supply a pair of bus-bars from this secondary and tap off three independent circuits, each with its own variable resistance and ammeter the resistance controlling the exact charging rate required. As the rectification will be accomplished by a double electrode rectifying valve, the

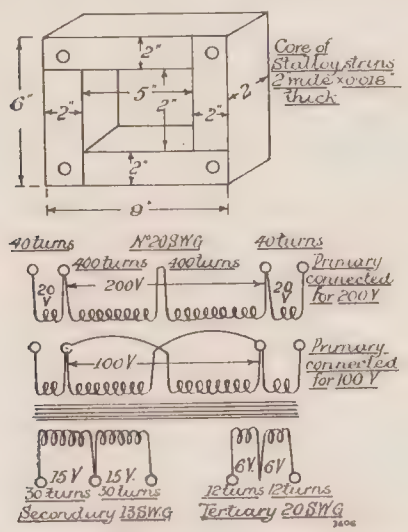


Diagram of Windings for Multiple Voltage Transformer.

transformer secondary will require to have a central tapping, providing 15 volts from either extremity of its windings to this centre point. There will also be a tertiary winding on the transformer for the purpose of supplying the filament heating current, this winding being tapped in the centre as well. To keep a clear view of these various requirements before one, reference should be made to the attached diagram. The change from 200 volts to 100 volts on the primary of the transformer can be made by recoupling the two halves of the windings, first in series for 200 volts, and then in parallel for 100 volts. Sufficient turns are added to each end of the primary coil to provide for 20 additional volts enabling 20 to be added to 200 for 220-volt service, and 20 plus 20 to 200 for 240-volt supply, connections being made to the appropriate terminals. This will hold good for various voltages provided that the circuit is always of the same frequency, but is unsuitable for more than one frequency. The design for the core given in the attached figure is for a 50 ∿ circuit, and windings are proportioned on the same assumption.

3629. Alternating-Current Motor Running Hot.—R. T. (Transvaal, South Africa).

Q.—I enclose sketches and particulars of a small 230-volt 50-cycle single-phase motor which overheats badly after running about 20 minutes. Are my windings incorrect, or can you suggest any other fault?

A.—The stator of this machine is 6⅜ ins. outside diameter, 3⅛ ins. bore, 2⅛ ins. length of core, with 48 slots, each of sufficient size to contain 58 turns of No. 22 S.W.G. D.C.C. Actually, they are now wound with varying numbers of turns per slot, averaging 46 only. The rotor core is 3 1/16th ins. diameter, but no other particulars have been supplied, and it is complained that it gets so hot that the solder round the copper end-rings melts. There is no mention at all of any starting winding on the stator, and it is to be presumed, therefore, that it is started by hand or some mechanical means. It would have helped also to form an opinion as to the cause of the trouble if the current, or, better still, the watts taken by the motor when running light had been stated. The dimensions specified should enable the motor to develop a continuous output of ¼ b.h.p. at about 1,440 r.p.m., but one very bad feature in the design is the excessive airgap between rotor and stator. This should not exceed 0.015 in. all round, and until this is correct it is not much use to spend further time over it. A new and larger rotor seems to be the remedy. So far as the windings are concerned, No. 22 is on the small side, and this again would tend to give a high temperature, No. 21 or two No. 24 wires in parallel would have been more suitable. The most essential feature of all in small A.C. motors is to provide good forced ventilation by means of an efficient fan and a correctly designed system of airways. Without these, temperatures are sure to be troublesome. Probably considerable assistance will be derived from reading the articles on the construction and winding of a ¼-h.p. A.C. single-phase self-starting induction motor which appeared in the July numbers of this journal for the year 1927.

3627. Building a ¼-h.p. Induction Motor.—B. F. T. (Newport Pagnell).

Q.—Will you give me particulars of a ¼ h.p. squirrel-cage self-starting induction motor to run off my 210-volt 50-cycle single-phase supply; or recommend a book containing the necessary information?

A.—Photographs, drawings, winding diagrams, and detailed particulars for constructing a squirrel-cage induction motor of this size, with automatic split-phase internal starting switch, are to be found in THE MODEL ENGINEER for July 7 and 14, 1927. The winding specification there given covers a voltage range of 200 to 220 or 230 volts 50 cycles. Literature on the subject of small induction-type motors is very scarce, as it is not a subject that can be treated in a popular way. Most of the designs at present available have evolved themselves out of "trial and error" methods rather than on lines of theoretical design, backed up by the results of practical tests and competitive market conditions. The motor described in the above numbers of THE MODEL ENGINEER is one that can be thoroughly recommended, as its performance equals some of the best American productions, and in this particular line of manufacture the States have a long start of us, owing to their standardisation of supply voltage and frequency.

PRACTICAL LETTERS from OUR READERS

Permanent Magnet Motors.

DEAR SIR,—Perhaps the following will be of interest and, maybe, assistance to "T. F. C.," of Boro Green, in designing his motor.

In 1921, whilst experimenting with a chiming and striking gear for my electric clock, I constructed a small double-armature motor having a permanent-magnet field. The principal dimensions can be scaled from the accompanying rough drawing. The aramtures were $\frac{7}{8}$ in. diameter (approx.) and were tri-polar, the winding being of No. 39 D.S.C. wire, series connected, and the joins between the coils being connected to the commutator, giving a two-circuit arrangement of the windings. I cannot remember the number of turns per coil, but if your querist would like this information, I can get one of the armatures and let him have further details. This motor ran splendidly on 4 volts, taking 0.25 to

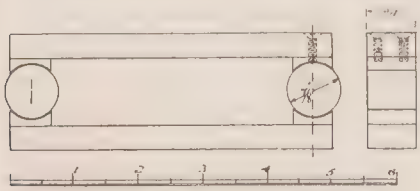


Diagram of Double Armature Motor.

0.3 amperes, and worked the chiming drum and striking gear with ease, one armature only being used at any time. The motor would also wind up the spring of Mr. Booker's self-wound clock (one turn in one minute, approx.) when geared down about 3,000 to 1.

For a motor to take 2 amperes at 6 volts, Messrs. Bassett-Lowke's locomotive motors are just the thing. These armatures are wound with 90 turns per coil of (I think) 28 S.W.G. The starting ends of the three coils are joined together and insulated, and the finishing ends are taken each to one segment of the commutator. This gives a single circuit arrangement to the windings. The armature of these motors are about 1 in. diameter if I remember rightly.

If "T. F. C." thinks that I can be of any further assistance to him, I shall be pleased to hear from him and help him to the best of my ability.

May I conclude by wishing your paper every success. I have recently renewed my support after a lapse of about five years, part of which time has been spent abroad.—Yours faithfully,

G. BRAHAM, Wh.Ex.

That Drill Press.

DEAR SIR,—In his characteristic way "L.B.S.C." disposes of my recent reference to the use of the term "drill press" by pleading that it is not such a mouthful as the conventional description, that it was used in the shops he has worked in and that it is applied to any drilling machine in America, at least, he believes so. Well, none of these wrongs will prove a right, they are not very ingenious excuses either for the use of a word which, applied to drilling machines, conveys no meaning whatever.

My idea of a first-class mechanic—this includes "L.B.S.C."—is that he has the sense of accuracy so ingrained into his nature by the continual use of three or even four places of decimals to his inch that it jars him to see inaccuracy elsewhere. We all know what it is to see a picture, say, out of straight. To an experienced mechanic a sixteenth looks like a mile.

A press is a machine for forming, by a process of squeezing, bending, indenting, drawing or shearing the material placed between its dies, one or both of which reciprocate, and reciprocate only. If we want to make a hole with a press we must shear the material between a punch and a die, using, in the case of thick stock, great pressure. Hence the term "punching press."

A drill, on the other hand, must rotate in order to use its cutting edges, which are moved forward into the material as it is removed. With a correctly-ground drill, no great pressure is required. A particular machine is made for the purpose of rotating and feeding the drill into the work, hence the drilling machine. I contend that these two methods of producing holes are fundamentally dissimilar and should not be confused.

That "L.B.S.C.'s" articles are followed closely by both young and old model engineers nobody can deny, and it is for the young mechanic that I plead. Teach him the correct name for his tools, then if he wants to use these slip-shod Americanisms—which are fast spoiling our beautiful and dignified language—he may. He probably will not want to.

At the risk of being included on the staff of his famous Inspector, may I suggest to "L.B.S.C." that he uses driller if he must abbreviate, it is even shorter than drill press.

In a way I can sympathise with him over his misfortune with the drill, because I did the same thing myself to somebody else's thumb. It was I who was called this, that, and the other, however, not the unfortunate "drilling machine."—Yours faithfully,

O. G. WILLIAMS.

Gramophones.

DEAR SIR,—I think Mr. T. E. Warren is under a delusion—his ears have deceived him.

A gramophone record does not record the base notes at their full volume, and the older gramophones did nothing to correct this. Thus gramophone users became accustomed to hearing music with half the base missing.

Now the modern instrument has a long, narrow horn—practically an organ pipe—which builds up the base to its true value, but to one accustomed to an old instrument the music sounds heavy; but after getting used to it one soon learns to prefer it to the old.

Mr. Warren can try an experiment. Choosing a time when he is alone in the house, he can sing something. Then let him sing again down a long postal tube. At once—

"The gentle zephyr of his song,
Is changed to glorious thunder."

This is what his new gramophone's horn does.

With all respect, I would advise him to leave well alone. An amateur can improve a cheap gramophone, but not a Columbia or H.M.V. He can improve a Ford but not a Rolls-Royce.—Yours truly,

N. R. CRAMP.

Steam-driven Electric Generating Plants for the Home.

DEAR SIR,—Having read "Lux in Tenebris's" letter in the April 3 issue, I should like to say that I consider his idea of having a coil through the kitchen fire as a means of raising steam for driving a generator, quite unsuitable. Surely one doesn't always want steam, and if there is no water in the coils surely it will soon oxidise with the heat of the average kitchen fire and be useless in no time. Also, there would have to be inconvenient connections from the range to the outside engine-house (which, by the way, would have to be close up to the wall of the

kitchen to avoid condensation) and to the water supply.

A much better way would be to employ a four-cylinder I.C. engine taken from a car. These can be obtained very reasonably now. One with a self-starter to operate from a six of twelve (twelve preferably) volt battery should be selected. It could be coupled direct to a compound-wound machine by means of one of the many flexible couplings obtainable. I say a compound machine because the following two things could be done with it:

(1) At a push from the starter button the outfit is ready for use for power work, such as operating the lathes, vacuums, etc., mentioned, simply by having a switch to throw the lighting cells out of circuit.

(2) By a simple movement of the switch the cells can be thrown in charge when desired.

A suitable switchboard could easily be designed, and a governor could be fairly simply made also for the engine.

Surely this would be simplicity itself even for the fair members of the household?

The main cells, by the way, could be tapped at 16 volts and a resistance and switch put in circuit with the starter battery to keep it charged.—Yours truly,

JAMES WIGHT.

The Fate of Many Experimental Engineering Productions.

DEAR SIR,—In reference to the letter on page 312, March 27 issue, it seems to be a rule, not the case of a few isolated experiments, that many novel ideas are ahead of their time, and fail through faulty mechanical means in making, or faulty methods of operation. One of the reasons militating against the *immediate* success of the gas turbine was the problem of finding blades to stand the high temperature.

It was the writer's unpleasant duty two years ago to tell an inventor that his idea was at least thirty-five years old, and that we could put our hands on a retired workman who had made the experimental batch of machine parts on the previous occasion.

He immediately countered with the foregoing argument. We made a batch bigger than he required, sold him 70 per cent., and are now holding the remaining 30 per cent. for some enthusiast of the next generation. *And he may succeed.*—Yours faithfully,

"SLIDERULE."

Lubrication of Foden Steam Wagons.

DEAR SIR,—Could any of your readers explain the object of the large displacement lubricator so conspicuous on "Foden" steam wagons of the older type? As these engines are fitted with a mechanical lubricator, is the displacement lubricator used in conjunction with it, or is it used merely in the event of the mechanical lubricator failing.—Yours faithfully,

A. ATTHILL.

Institutions and Soceities.

The Society of Model and Experimental Engineers.

MEETINGS.—At Caxton Hall, Westminster, at 7 p.m. Wednesday, April 30, Competition, Track and Model Night. A prize of 5s. will be awarded for the best example of mottling shown on this evening.

WORKSHOP.—On Monday, May 12, a demonstration on "Metal Finishing and Lacquering," by Messrs. H. G. Eckert and H. Hildersley jointly. On Monday, May 26, a demonstration on "Forging," by Mr. H. Sillick.

Full particulars of the Society may be obtained from the Secretary, R. W. WRIGHT, 202, Lavender Hill, Enfield, Middlesex.

Manchester S.M. and E.E.

NEXT MEETING.—April 25, Friday, at the Manchester Technical Schools at 8, open night; new members will be welcome.

Hon. Secretary and Treasurer, 20, Albert Place, Longsight, Manchester.

Hon. Secretary and Treasurer, W. E. WOOD, 20, Albert Place, Longsight, Manchester.

Bolton Society of Model Engineers.

NEXT MEETING.—April 22, to be held in the Y.M.C.A. Institute, Deansgate, Bolton, at 8 o'clock p.m. prompt. Will all members make a special effort to attend.

Hon. Secretary, A. TAYLOR, 203, Hatfield Road, Bolton.

Leicester Society of Model Engineers.

NEXT MEETING.—Thursday, April 17, at 8 p.m., in Swiss Café, Welford Road, open meeting. Members please note this will be the last meeting in these rooms.

Further details at meeting or from Secretary, J. H. RILEY, "Earlsdon," Scraptoft Road, Leicester.

The Walthamstow, Leyton and District Model Railway Club (Steamboat Section).

We have now added a Steamboat Section to the above Club. The first meeting was held on April 3, when a very interesting and instructive address was delivered by two members of the Victoria Model Steamboat Club. We cordially invite all interested in power boats in this district to become members. Meetings are held at 8 p.m. every first and third Thursday in each month at Christchurch Mission Hall, Shrubland Road, Walthamstow, E.17.

Hon. Secretary, J. Presswell, 40, Lansdown Road, E.17.

Notice.

The Editor invites correspondence and original contributions on all small power engineering, motor and electrical subjects. Matter intended for publication should be clearly written on one side of the paper only, and should invariably bear the sender's name and address. It should be distinctly stated, when sending contributions, whether remuneration is expected, or not, and all MSS. should be accompanied by a stamped envelope addressed for return in the event of rejection. Readers desiring to see the Editor personally can only do so by making an appointment in advance.

All subscriptions and correspondence relating to sales of the paper and books to be addressed to Percival Marshall & Co., Ltd., 66, Farringdon Street, London, E.C.4. Annual Subscription, £1 1s. 8d., post free to all parts of the world.

All correspondence relating to Advertisements and deposits to be addressed to THE ADVERTISEMENT MANAGER, "The Model Engineer," 66, Farringdon Street, London, E.C.4.

Sole Agents for United States, Canada and Mexico: Spon and Chamberlain, 120, Liberty Street, New York, U.S.A., to whom all subscriptions from these countries should be addressed. Single copies, 14 cents; annual subscription, 5 dollars 50 cents, post free.

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If you are quite a novice, or even an old hand, and require some information about a job of turning on your "Drummond," or regarding say, the best method of installing your lathe, write us. Our Service Department will assist you if at all possible—without obligation of course.

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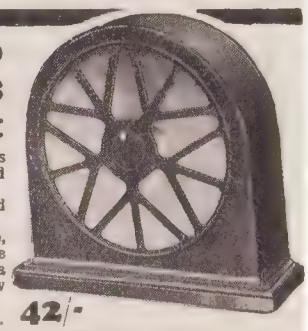

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"The Model Engineer"

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Twelfth Year

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All advertisements in these columns must be prepaid, *and remittances should be made by Postal Orders or Stamps, and sent to the Advertisement Manager, "The Model Engineer," 66, Farringdon Street, London, E.C.4.*

Please state under which Classified Heading you wish your advertisement to appear; the classifications are as follows:—

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Tools, Engines, Electrical, Business, Wanted.

Advertisers are requested to send in their announcements as early in the week as possible, as although we accept advertisements up till the first post on Friday preceding the date of issue, **we cannot guarantee the insertion of these arriving on this day.** *Telephone: Central 9071.*

OUR DEPOSIT SYSTEM.

We will receive from intending purchasers the purchase money of any article advertised or sold by our advertisers, and will acknowledge its receipt to both the Depositor and the Vendor, whose full names and addresses must be given. Unless otherwise arranged beforehand between the parties, it is understood that all goods are sent on approval, and that each person pays carriage one way if the goods are returned. The deposit is retained by us until we are advised of the completion of the purchase, or of the articles having been returned and accepted. In addition to the amount of the deposit, a fee of 1/- for the sum of £1 and under, and 1/6 for amounts in excess of £1, to cover postage, etc., must be remitted at the same time, and sent to the Advertisement Manager, "The Model Engineer," 66, Farringdon Street, London, E.C.4. In cases of persons not resident within the United Kingdom, double fees are charged.

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In cases of exchange, money to the value of the article should be deposited by each party. **We cannot receive the articles themselves.**

General

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2¾ h.-p. Douglas Engine for sale, with magneto, carburettor, silencer, etc., perfect condition, 25s.; Douglas 2-speed Gear-box, with controls, 7s. 6d.; two practically new 26×2¼ Dunlop Tyres, 4s. each; Box Electrical Goods, switches, plugs, etc., 4s. 6d.—H. NELSON, 24, Dorset Gardens, Brighton.

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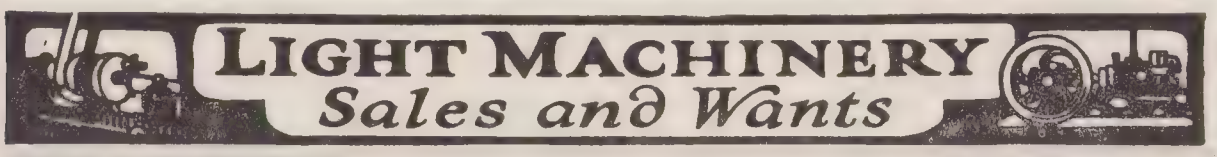

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(Continued on next page).

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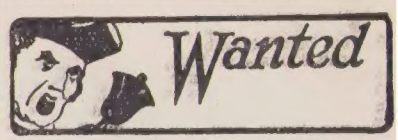

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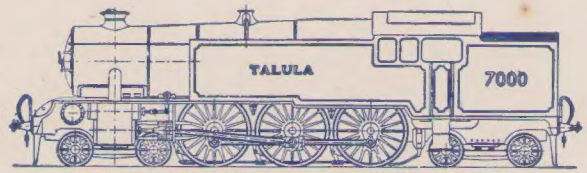
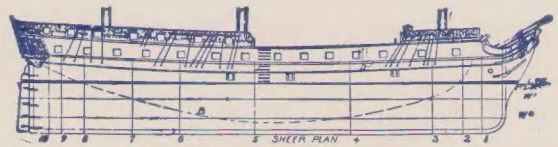
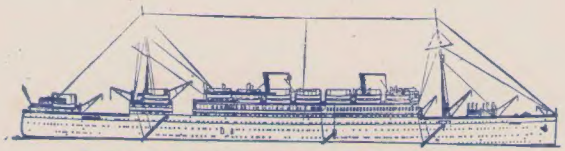


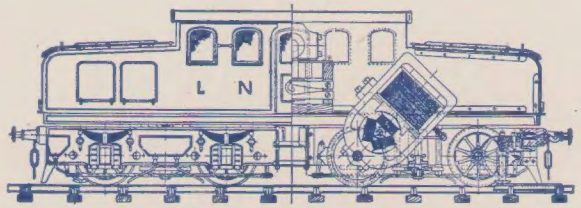
BALTIC TANK LOCOMOTIVE, "TALULA," 2½" Gauge.
Folding plate appears in Part 2, and details for building appear in Parts 2 and 3.



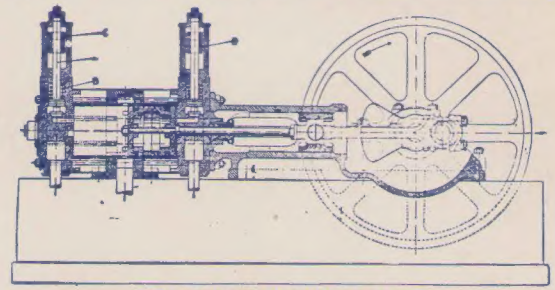
MODEL 50-GUN FRIGATE, Period 1780.
Plate and full details for building appear in Part 6.



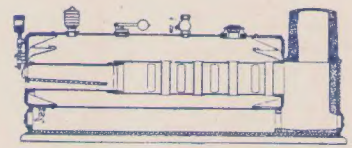
ROYAL MAIL MOTOR VESSEL, "ASTURIAS."
Folding plate and all details for modelling are given in Part 1.



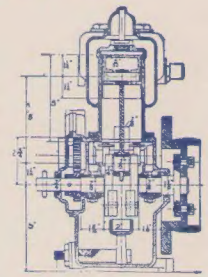
MODEL ELECTRIC LOCOMOTIVE for 2½" Gauge.
Plate appears in Part 5, and full details for building are given in Parts 5 and 6.



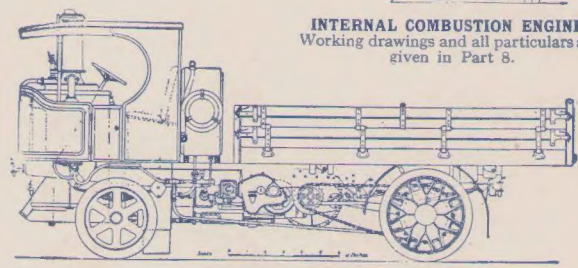
MODEL UNIFLOW MILL ENGINE.
Design and all working drawings appear in Part 10.



MODEL GALLOWAY BOILER.
Plate and full particulars appear in Part 7



INTERNAL COMBUSTION ENGINE.
Working drawings and all particulars are given in Part 8.



MODEL ROAD WAGON.
Folding plate appears in Part 12, and the details for building the model are in Parts 12 and 13.

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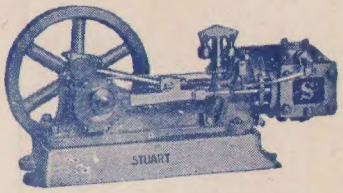

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